Volume IX No. 3 Fall 2001

QRPp

Journal of the Northern California QRP Club

Table of Contents

From the Editor

by Doug Hendricks, KI6DS

This issue is special to me. The theme for this issue was one page articles of interest to QRP. Some are a little longer, but I think you will agree that all belong in this issue. A simple idea, turned into a really big experience for qrpers. Enjoy the issue, and have fun on the air, building, or whatever you do to be a qrper. The credit for this issue must go to the authors. Thank you from a grateful editor for your contributions.

72, Doug, KI6DS

ArkieCon 2002 Will Be Very, Very Special

by JayBob Bromley, W5JAY
w5jay@alltel.net

Arkiecon 2002 is gonna be another great time in Ft. Smith. We have had some outstanding speakers at past Arkiecons, Dave Gauding, Jim Kortge, Doug Hendricks, Chuck Adams, Jim Duffey, Glen Leinweber, George Heron, Sir Tony Fishpool, and Lord Graham Firth. This year we have a special treat for all of the hams in the midwest. Rev. George Dobbs, G3RJV, is probably the most famous qrper in the world, (sorry Tony, you are still number 2). George has found time in his very busy schedule to fly to Fort Smith and be the headline speaker for Arkiecon 2002. George has spoken at just about every qrp event in the world, and we are thrilled that he has accepted our invitation to come to Fort Smith. Also, Ed Manual, N5EM who was a headliner at Pacificon is confirmed, and we are working on getting 2 more world class speakers to come. Trust me when I tell you that we will get the best to come to Arkiecon. Arkiecon is a unique experience, the down home hospitality of the local group is an experience that you will never forget. Hanging Judge Kelsey Mikel, Governor Win Dooley, Keith "the builder" Newman, Nick Kennedy, Dub Thornton, Burl Keeton, Dennis Foster, Dennis Schaeffer, all will be there. Then you add in the guys from Missouri, the great bunch from Texas, the Iowa and Nebraska guys, the Kansas QRPers and you have a great mix of qrp friends having a blast.

Arkiecon is not just forum speakers. There is a great flea market and hamfest which is INDOORS!! The facility is fabulous, and the weekend is filled with activities. Friday night has a no host dinner featuring Turkey Fries and Fried Cukes as appetizers. Saturday afternoon and evening we set up stations for you to operate and try the rigs and antennas out. We will have a 4 band K1 and an 817 with the filters so you can check them out. You will be able to try a Vern Wright MP-1 antenna. And we will have well known Qrpers there from all over the US. Jim Cates, Doug Hendricks and Vern Wright are definitely coming from California, Jim Duffey will be hear from New Mexico, Dave Yarnes from Arizona. All will be here renewing old acquaintances and making new ones.

The Guest House motel will again be the qrp headquarters, and you will get a great room in a motel that is just 3 years old, and the price is right!! Plus, it is only a half mile from the convention center.

Please take this as your personal invitation to join us this year at ArkieCon 4 in Ft. Smith, Arkansas on April 6th.

See you there. 72, JayBob

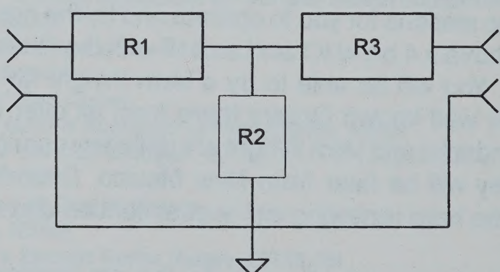
QRP Fixed Attenuators, Manhattan Style

by Mike Schettler WA6MER
6244 Aura Ave.
Tarzana, CA 91335

Ever need a fixed attenuator for reducing the output of a QRP transmitter, or perhaps to check your receiver sensitivity? It's getting difficult to find a source of non-inductive power resistors. Radio Shack sells inexpensive 1 Watt metal-oxide resistors at 2 for 49 cents. However, R/S only stocks 10, 100, and 1K ohm values.

A look at the ARRL Handbook attenuator table was intriguing. The calculated values for a 4 dB, an 8 dB, and a 14 dB T-pad were very close to those you can make from the R/S parts, using simple series-parallel combinations. I built up an 8 dB T-attenuator using two of the 10 ohm resistors for each series element, and two of the 100 ohm resistors in parallel for the shunt element. This yields 20 ohms for each series element, and 50 ohms for the shunt element. A little math shows the impedance looking into this pad is about 49.2 ohms. Plenty close enough! The most power dissipated by any resistor (assuming a 4.9 Watt input) is about 1 Watt.

I built one Manhattan style on a small piece of copper-clad board and checked it out using an MFJ SWR analyzer. SWR is less than 1.1:1 up to about 11 MHz. It rises to about 1.2:1 at 20 MHz, and 1.25:1 at 30 MHz. Keep those resistor leads short! I measured attenuation at 7.8 dB up to about 12 MHz, and 7.5 dB at 30 MHz. Enclose the attenuator in more copper-clad board or a small housing of your choice.



So what do you get for $1.50 worth of R/S resistors? (OK, plus connectors). A 7.5 dB attenuator capable of handling 4.9 Watts, and good up thru HF. It will reduce a transmitter output from 4.9W to 870 mW. Add a second one for another 7.5 dB reduction, you're down to 155 mW. Much safer for feeding into a piece of test equipment or trying

QRPp. Building a 3.6 dB T-attenuator takes only two of the 10 ohm resistors and a single 100 ohm. It should handle 3.4 Watts input. See the table below for the details.

Atten.	R1 Series	R2 Shunt	R3 Series	Max Input
3.6 dB	(1) 10 ohm	(1) 100 ohm	(1) 10 ohm	3.4 Watts
7.5 dB	(2) 10 ohm in series	(2) 100 ohm in parallel	(2) 10 ohm in series	4.9 Watts
14dB	(3) 100 ohm in parallel	(2) 10 ohm in series	(3) 100 ohm in parallel	4.3 Watts

Tweaking The Warbler

By David D. Meacham
206 Frances Lane
Redwood City, CA 94062
W6EMD@prodigy.net

Here are the mods I made to my New Jersey QRP Club PSK-80 Warbler:

IMD Improvement Mods

1) Cut the trace (on the top of the board) that connects the emitters of Q5 and Q6. It goes between R13 and R13A. This separates the degeneration circuits.
2) Replace R12 with a 1N4001 diode with the cathode going to ground. Mount the diode on the under side of the board.
3) Above the board, solder a 100uF, 6.3V Tantalum capacitor to the same pads as the diode, negative to ground.
4) Change R11 to a 150-Ohm, 1 Watt resistor. Stand it up vertically. Changes 2, 3, and 4 stabilize the bias voltage on Q5 and Q6.

Filter Improvement Mods

In my rig the following filter changes gave me a very flat TX bandpass, and a lower-ripple RX bandpass. My TX 90% power points are 3.5801MHz and 3.5809MHz. My RX 70% power points are 3.5799MHz and 3.5809MHz.

1) Change R6 to 1.2k. This makes a better output termination for the TX filter.
2) Add a 5.6k, 1/8W resistor from pin 3 to pin 5 of U1, directly above

the IC. This makes a better input termination for the TX filter.
3) Change R15 to 1.0k. This makes a better input termination for the RX filter.
4) Add a 2.2k Ohm resistor from pin 1 to pin 2 of U2 under the board. This makes a better RX filter output termination.
5) Change R17 to 330 Ohms to restore the gain lost in step 3.

TX Audio Gain Reduction

I needed to reduce the TX audio gain to suit my sound card. This mod
accomplishes that in addition to providing a 600-Ohm load. Just cut the trace going from C101 to J2 on the top side of the board, and solder a 510-Ohm resistor from the ungrounded pad of C101 to the nearest pad on J2 on the bottom side of the board. Then solder a 100-Ohm resistor across C101 (Bottom of board).

Extended Rolloffs for RX Audio

Most of the original corner frequencies were too low at high audio frequencies, and too high at low audio frequencies, degrading the filter response. These changes move the rolloffs outside the filter bandwidth:

1) Change C21 to a 0.47uF (474) mono capacitor.
2) Change C20 to a 0.001uF (102) disk ceramic capacitor.
3) Change C22 to an 8.2pF mono or disk ceramic capacitor.

Other Mods

1) Change C10 to 330pF for a better match. This increases output power. (From the NJ QRP Club website)
2) Change R5 to 220 Ohms. This maintains 7.5V regulation under varying loads. (From Mike Gipe, K1MG)
3) Change D6 to a 1N5817 (1A Schottky). This reduces voltage drop by about 0.35V.
4) If the RX gain is not high enough to suit you, add a 0.01uF (103) disk ceramic capacitor across R17 on the bottom side of the board. If this change increases the gain too much in your system, reduce the value of R24 to suit your taste.

These "tweaks" made a great little rig even better for me. If you try them, I hope you like the results, too. 72, Dave

Airport Security and Pacificon 2001

by Dave Redfern, N4ELM
n4elm@home.com

With all the changes to airport security in the last few weeks, I was unsure about carrying radio gear on the plane for Pacificon. I would be flying from Dallas' DFW Airport to Oakland International Airport and back. I checked the airline carrier's web page for the latest updates and decided on a plan, I would pack most of the hardware in checked baggage and carry-on the main radios and computer.

I wanted to operate HF and display some gear in the hospitality room so I settled on three bags. The first bag was a RubberMaid "Action Packer" bin (~20X13X11 inches) with a locking top and contained radio gear. The second bag was a standard roll-on bag and contained antenna parts, misc. items, and clothes. The third bag was a double compartment Targus computer bag and was used to carry-on the computers, and radios. I also used a fold up wheeled cart to bungee all the bags together and roll as one unit.

All the radio and computer gear including power supplies, cables, tools, cases, and connectors was distributed among the three bags. I made sure that the third bag (carry-on) did not have any of the prohibited sharp objects and that the radios, PC, and cell phone had batteries so that they could be turned on if necessary. The first bag contained: NorCal/RedHot 20, Red Hot Box, Wilderness Sierra and band modules, Elecraft K1 with case, two NiMH battery chargers, 30 ft. RG-8X coax, 12 ft 300 ohm twinlead, 32 ft. 18ga. Wire, connectors, power cables, screwdriver, & pliers. The second bag contained: clothes and toiletries, MP-1 antenna, MP-1 mast extension, ground stake mount for MP-1, RS switching power supply, and a Kent iambic paddle & case. The third bag (carry-on) contained: a Libretto 100CT laptop, PSK-31 interface, Yaesu FT-817, LDG Z-11 tuner, KK5PY Te-Ne-Key, Yaesu VX-5R HT, Nokia cell phone, Palm IIIe, 2 baluns, mike, power supplies, and cables.

On the outbound trip to Oakland, in Dallas, the first two bags and the cart were checked luggage at the ticket counter. These bags and the cart were run through a large x-ray scanner beside the ticket counter. No questions or problems. I carried the third bag through security to the gate. Per the written instructions, I removed the PC and ran it through the x-ray scanner separately from the bag. Again, no questions or problems. Even with a lot of lines in the busy midmorning, from the start of the ticket counter line until I got to the concourse only took about 1.5

hours.

After a great two days at Pacificon, late Saturday night I discovered that I had acquired several more items to try and fit into my already bulging luggage for the return trip. Like many others, I could not resist the new 4 band module for the K1. In fact I brought back two, one for me and one for a friend, along with a KAF-1 for his K2. I also got a couple of Jerry Parker's very colorful shirts, Vern Wright gave me a nice 12 volt gel cell battery, and I scored some 1800 mah NiMH batteries for my K1 and a Wilderness Ops case for the FT-817/Z-11. I managed to cram all the new stuff into bags 1 & 2.

The return trip through the Oakland airport was a little more interesting. Due the large crowds and confusion seen on my arrival on Thursday, I got to the airport about four hours early on Sunday. Again, I checked the first two bags and the cart at the ticket counter with no problem. The line down the hall to the security checkpoint was long but moved well. Again per the written instructions, I had removed the PC to pass through the scanner separately. This time, the scanner operator yelled at me that I had to remove the computer from the bag (this was after he watched me take out the Libretto in the first place). When I explained that I had already removed the computer, after basically implying that I was not telling the truth, he asked what was in the bag. He seemed puzzled with the answer of "radio gear" and finally decided that the FT-817 and the Z-11 needed to go through separately. With that hurdle cleared, entire trip from the beginning of the ticket line to the concourse took about 2 hours. The rest of the trip back to Dallas was pretty uneventful.

For this trip, due to the Pacificon activities, I was carrying more radio équipment than usual but most of it was in checked baggage. My carry-on bag contained about what I usually take when traveling and carrying radio gear. Since it appears that the rules differ slightly from airport to airport my best suggestion is to be flexible and polite at the security checkpoints. In general though, I was successful in taking all the different equipment which added an extra highlight to my participation in the QRP activities at Pacificon.

Dave Redfearn, N4ELM

MP-1 Ground Stake Mount

by Dave Redfern, N4ELM
n4elm@home.com

Vern Wright's MP-1 is an excellent antenna system for portable use. The tripod mount works very well but the antenna may tip over on a windy day. As an alternative, I have built a stake mount for the MP-1

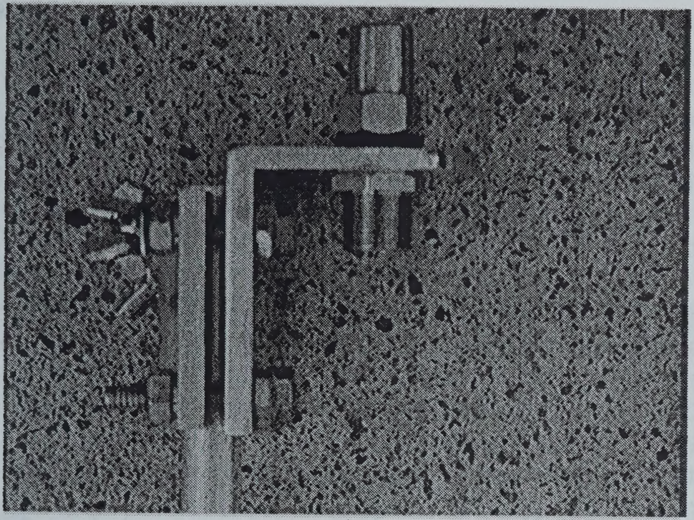


Fig. 1 Close up of the Mount to the Stake

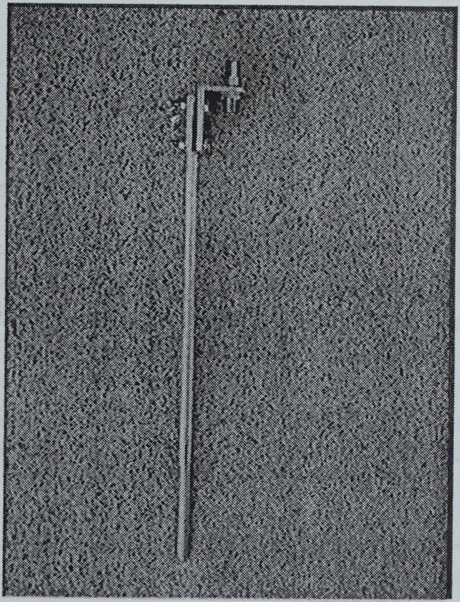


Fig. 2 Full Length View

that can be pushed into the ground and will hold up the antenna under windier conditions.

To make the mount, I bought a mirror mount with a SO-239 to 3/8 X 24 threaded socket. This style mirror mount has a "V" groove on one of the mounting plates, which can be positioned vertically. These may be available from Radio Shack, Amateur suppliers, or CB shops. At a local hardware store, I purchased a 1/2" solid aluminum rod, 36 inches long that would fit in the mirror mount. I cut the aluminum rod in half (18"), attached one end to the mirror mount, vertically, then sharpened the other end with a bench grinder (or file). I mounted a lug under one of the mirror mount bolts to accept the connector from the MP-1 radials.

To use the stake mount, push it into the ground, attach the coax to the SO-239, plug in and fan out the radials, and thread the MP-1 base into the 3/8 X 24 socket. Tune-up the MP-1 as normal.
Total cost for this project was about $15.00 and I was able to use the remaining aluminum rod for a second stake mount.

This mount can also be used for other HF antennas that use 3/8 X 24 threaded mounts, like HamSticks, Outbackers, or Hustlers.

Dave Redfearn, N4ELM

QRP Usage of Fixed Attenuators

by Mike Schettler WA6MER
6244 Aura Ave.
Tarzana, CA 91335

OK, so you bought or built a resistive attenuator. Now what? And what are those 'dB' things all about? This article will attempt to provide some guidelines and a little math that will help answer some of your questions. A little high school algebra never hurt anyone, right Doug?

Attenuators are used to reduce a power level to a lower power level. Similar to resistive voltage dividers, they instead are designed to maintain a fixed impedance. For our QRP discussions, I will assume that we are talking about a 50 ohm impedance, as found in RF transmission lines. Why would anyone want to reduce an RF power level? A few examples: 1) to try QRPp; 2) to check out a receiver's sensitivity; 3) feed a transmitter output into a spectrum analyzer to determine harmonic and spurious content.

Now for the math. (A simple calculator is needed. You can do this!) An attenuator is described in terms of its decibel or 'dB' rating. This is given by the equation:

$$dB = 10 * \log (P2 / P1)$$

where P1 and P2 are the power levels before and after the attenuator, and log refers to the 'log' key on your calculator.

So if I want to reduce a power level by a factor of one-half,

$$dB = 10 * \log (1/2).$$

If you do the math, you come up with –3.01 dB. This is an important example to remember. A 3 dB attenuator reduces the power by a factor of one-half. Another example to remember is that a 10 dB attenuator reduces the power by a factor of one-tenth. The proof is left for you to verify. Attenuators can be strung together to yield greater reduction in power. Putting a pair of 3 dB attenuators in series will produce a power reduction of one-fourth of the input power, or a 6 dB reduction.

But what if I have an 8 dB attenuator and want to determine its effect on my 2.5 Watt transmitter? The equation above can be re-written as:

$$(P2 / P1) = 10 \text{ ^ } (dB / 10)$$

The '^' symbol means "to raise to the power of". So using the 8 dB example, we get: (and don't forget to put the negative sign in the equation for the attenuator value)

$$(P2 / 2.5) = 10 \text{ ^ } (-8 / 10)$$

This can be re-written as

$$(P2 / 2.5) = 10 \text{ ^ } (-0.8) = 0.153$$

$$\text{If } (P2 / 2.5) = 0.153, \text{ then } P2 = 0.396 \text{ Watts}$$

That's all there is to it. If you use an attenuator to try QRPp, don't leave it in ahead of your receiver input!

Record 80 Meter Tuna Caught Off Shores of Ft. Smith

by Nick Kennedy, WA5BDU
nkennedy@tcainternet.com

When our club decided to build some Ft. Smith tuna-tins as a group project, I couldn't resist getting in on it. But I already have a TT-2 on 40, so I decided to convert to another band. Since winter is coming, and the only QRP crystal I have is for 80, I decided that would be the band.

A few guys asked how I would approach making the change, so I'm going to describe it below.

Generally, it's those frequency sensitive L's and C's that have to change. And the simplified approach is to use the ratio of the old frequency to the new frequency as a multiplier. So take 7 MHz divided by 3.5 MHz, times the values of C and L. That keeps their reactance the same as the band changes. This is called frequency scaling. Of course, I used the actual ratio of 7.04/3.579, but just plain two would have worked for most

of them.

Like I said, that's the simplified approach. Now some of the capacitors are for bypassing—they're selected to look like a short circuit compared to the component they bypass. That would be all of the 0.01 uF and 0.1 uF capacitors. I left these as-is. There reactance is still acceptably low on 80 meters. If you wanted to crank 'em up to 0.02 and 0.2 uF, that would be OK. You could do a reasonableness check by calculating the reactance of these components. So 0.01 and 0.1 uF are 2.2 and 0.2 ohms reactance respectively on 40 meters. On 80, they'd be twice that. So look at some of the resistances they bypass: 220 and 100 ohms bypassed by 0.01uF, and 56 ohms bypassed by 0.1 uF. So the reactances at 80 meters are still small with respect to those resistances. I didn't change 'em.

Now look at the components between the oscillator and amplifier. C2 (100 pf) is part of the oscillator feedback network, per Doug Demaw. The oscillator would probably be fine with no change here, but I figure when in doubt, keep the same reactance. So I doubled the capacitance. Now 200 pF isn't exactly a standard value, so I'd go with 180 pF or 220 pF, whatever's in the drawer.

L1 is just a choke, shunt feeding DC to the oscillator. Again, when in doubt, use the ratio thing. Now one handy thing to recall about toroids is that the inductance is proportional to the square of the number of turns. This one has 7 turns. Seven squared is 49. It doesn't take a whole lot of head scratching to come up with the fact that ten squared is

100, almost exactly twice 49. So I just bumped up the turns count from 7 to 10 to double the inductance of L1.

C4 at 220 pF couples the oscillator to the base of the amplifier. Again using the "when in doubt" rule, I doubled it. Since 440 pF isn't a standard value, I used 470 pF.

Moving further to the right, the next component is T1. We didn't talk about transformers. This one just transforms the 50 ohm load resistance to the desired resistance for the amplifier. This ratio actually sets approximately how much power you'll get from the amplifier. I don't want to change that, so I won't change the ratio. But is the transformer broadband enough to work on 80? Probably is, but let me see if I can tweak it a little. The primary has 10 turns and the secondary has 5. I can change those to 14 and 7. That will keep the ratio at 2:1, so I won't mess up the impedance transformation. But now the inductances of primary and secondary are now almost exactly twice what they were before, per the turns-squared rule. So the reactances of the windings on 80 will be the same as the were on 40. So I made that change. (One rule on transformers is for the reactance of the windings to be large compared with the connected load. That's why I chose not to let it drop as frequency dropped.)

Next comes the output filter. Things get a little trickier in filters and resonant circuits. Previously, keeping approximately the same value of reactance was OK. Here you might need to be a little more careful. There are several ways to go. One is to use the scaling technique described earlier. But resulting values might be hard to match with standard components. Another might be to select (or design) a lowpass filter from ARRL handbook tables. Or you could try the scaling technique, substituting standard values and verifying the results. I use a circuit analysis program called Electronic Workbench. There are many others that would work as well. Alternately, you could breadboard the filter, hook a 50 ohm resistor to the output and shoot through it with your MFJ-259B. Or your QRP rig and SWR meter. That might not tell you the attenuation at harmonics, but it would at least insure negligible insertion loss at the desired frequency. Near 1:1 SWR means things should be OK.

I did my cut-and-try with Electronic Workbench. This is a T37-6 core with 17 turns on it. Using standard numbers and formulas from the handbook or Amidon, that's 0.867 uH. That scales up to 1.71 uH.

Calculating back the other direction gives almost exactly 24 turns required for the 80 meter version. But I did something a little compulsive—I notice that the type 6 (yellow) cores are said to be for 3 to 50 MHz—which is OK, but the type 2 (red) ones are good for 1 to 30 MHz.

So 80 is a bit more well-centered in the type 2 core's range. So I swapped to a red core since I have lot's of 'em in my junk box. But don't special order one—the yellow should do fine. With all my trial and error work, I finally came up with a value of 1.6 uH, using 20 turns on the T37-2 core. (That's one more nice thing about electronic simulation—you can do "sensitivity checks" to see if it really matters much whether you the exact value or one that's merely close.)

Going through similar measures, I came up with a value of 768 pF (I actually had one in my junk box!) for C6 and 910 pF (but 1000 pf or 0.001 uF would have worked OK) for C7.

Whew! Takes longer to describe it than to do it. Finally, that cap across the backbone of the filter—C11. You'll see this in some designs but not in others. It forms a parallel resonant circuit with L2 to give extra attenuation on the 2nd harmonic. I was surprised when I first saw this—surprised you could do something so simple and not mess up the performance of the filter in other respects. But it works. I'd select C11 rather carefully to make sure it resonates L2 at exactly twice your operating frequency. I used a value of 330 pF. It won't hurt things much if you're off here, you just won't get the maximum value out of this extra feature.

I was amazed and gratified when I powered the thing up and it looked fine right off the bat—nice clean sine wave and about 700 mW output.

I wired up my can with the two UHF connecters and the toggle switch T/R switch (hey—just like back in 1962). I also put a 1/4 phone jack in the can for my key and a coaxial type power connector from radio shack.

Then I did the "chirp elimination mod". But that's not what I'd call it. My 40 meter TT2 didn't chirp that badly. But I didn't like the fact that both sides of the key had to be insulated from ground in the basic design. I wanted to use my keyer but didn't want to have to worry about whether it's case touches ground. With the modification, the shell side of the keying connector is at ground just like on any other rig. On my TT2/40—I did this mod manhattan style on the back side of the board. But I'd misplaced my super glue while doing the TT2/80, so I did the mod "islander style", using that island cutter sold by the NJ group. It worked fine. Those islands are kinda teeny, but I managed so solder four leads to one.

I still haven't described the toughest component choice I had to make. My wife saved me two cans—a BumbleBee and a Chicken of the Sea. But on close inspection, the CotS wins hands down. It's got that pretty little blonde mermaid. She's stirring the ionosphere with

what looks like a quarter wave monopole. You can seen the positive ions swirling. Remove the label carefully before doing the metal work. Then cut out the mermaid and glue her back on. Also, I cut out the tiny "dolphin safe" sticker and stuck it on the board, so my environmentally conscious kids would know that no friendly creatures were harmed in the making of this transmitter.

I always skip through equipment reviews to get to the on-the-air description at the end. Well folks, there's hardly anybody that's moved down to 80 meters yet. It's still too early in the low-QRN months of fall/winter I guess. I pounded the brass in vain yesterday and last night and finally sent an email to milliwatt-king Jim, KJ5FT. He agreed to listen for me this morning as soon as he could get a cuppa coffee. We had a good QSO. Jim had to go QRO (2 watts!) to overcome my noise, but the QSO is much appreciated. Jim is trying to scare me up a 3560 crystal for the AR QRP net, but I'm thinking I may try to build a VFO for this thing. Or else I'll just QRP the FT-1000.

Now, so you'll never have to wade through all that mess again, let me summarize the component changes necessary to build the TT2/80:

Component	**Old**	**New**
C2	100p	180 to 220p
L1	7 turns	10 turns
C4	220p	430 to 270p
T1	10T/5T	14T/7T
L2	17turns	24 turns OR ...
L2	T37-6	T37-2 with 20 turns
C6	390p	768p or thereabouts
C7	470p	910p or 1000p

Unchanged—all resistors, C1, C3, C5, C8, C10, C9

Oh yeah, a couple more handy things for homebrewers. Those calculated values for toroids are kinda ballpark ... usually OK, but sometimes you need to get close. The AADE L/C Meter IIB is sure handy when you want to get close to a critical value. I think I ended up adjusting my L2 by one turn ...

Another thing that's handy is a spreadsheet set up to automate calculations of resonant frequency, reactance, toroid turns and a bunch of other stuff that you use a lot. It's good to make your own, adding stuff as you encounter and learn about it. But if you want mine, let me know. Requires Excel 97 or later.

72 & see you on 80—Nick, WA5BDU

THE 360-DEGREE OPERATING CHALLENGE

By Paul L. Conant, Jr., WQ5X
1004 Morningside Drive
Grand Prairie, TX 75052-1634

QRP enthusiasts compensate for low power with superior skill. They adorn their walls with all the awards of which QRO operators boast, but hang them up beneath their 1000 Mile per Watt award. This article describes the 360-degree operating challenge, another way to demonstrate amateur radio accomplishment on the HF bands.

Subscribers to the QRP-L e-mail reflector have access to a useful command: **run qrp-l x calls2dist <your_callsign> <their_callsign>**. This command responds via e-mail with the heading and distance to stations you have worked. Enter this data in an Excel spreadsheet and display it in a scatter chart. You will likely see a dense cluster of points in one general direction. The remaining points are thinly spread around the rest of the chart, separated by conspicuous open areas. The challenge is to fill in the gaps and the goal is to log QSOs at each of the 360 points of the compass. That accomplished, print off your scatter chart for a customized award and unique demonstration of your operating skill. Along the way, you can take pleasure in intermediate accomplishments like having worked stations at 0, 90, 180, and 270 degrees, and other principal points on the compass.

The 360-degree challenge will require you to evaluate the effects of your operating habits. Varying the time of day that you operate may be the single most important factor in filling the gaps on your scatter chart. The performance of your antenna system will be highlighted. You will become increasingly conscious of what it takes to fine-tune your capability to communicate in every direction.

Logging heading and distance to your contacts will reveal interesting geographical connections. You may be surprised at the cities and countries that lie along a particular path. You will begin to associate compass headings with distant locations, even if you do not have an antenna rotator. You may investigate what locations lie along paths you have not worked and actively seek them out.

Completing the 360-degree operating challenge would be a significant accomplishment for any station at any power level. At QRP power levels, you will enter the ranks of truly distinguished radio amateurs. Along the way, you will have mastered an impressive body of knowledge, but more importantly, your will have had an immeasurable amount of fun. I look forward to working each of you while working on my 360-degree challenge. 72 de WQ5X!

Vectronics QRP Transmitter and Receiver Kits

By Paul L. Conant, Jr., WQ5X
1004 Morningside Drive
Grand Prairie, TX 75052-1634

You may have seen them in ads in QST, on display at the MFJ booth at hamfests, or in the Radio Shack catalog. The Vectronics VEC-1230K QRP transmitter and companion VEC-1130K receiver kits are priced at $29.95 each. They occasionally appear on sale at $19.95. Enclosure kits can be ordered separately. How well do they work?

This writer built both kits, with enclosures, for 30-meters. The VXO controlled one-watt transmitter tunes several kilohertz around 10.108 MHz. There is a switch for an optional crystal, not provided, that extends the range of the transmitter. The receiver covers the entire 30-meter band. Based on the popular NE612, it is quite sensitive, but has little selectivity. Don't let that turn you off. Adjusting RF gain controls receiver volume. The transmitter can be connected to the antenna through a T-R switch in the receiver. An internally mounted 9-V battery powers the receiver. An external 12 to 15-V power supply, not included with the kit, provides transmit power from QRPp levels to more than a watt. Each kit goes together in just a few hours. The instruction manuals are very well written. Even an inexperienced builder like me can follow them easily and reasonably expect to complete a rig that works the first time.

On-air results are what really count. These kits exceeded my expectations in dozens of contacts with ranges up to 1500+ miles. I received numerous positive comments on the sound of the transmitter. More often than not, I received reports of signal strength between S4 and S6. One must turn the receiver RF gain control all the way down when sending. This is a crude, but effective, way to save the ears. The poor selectivity of the receiver allows the operator to monitor a range of frequencies simultaneously. This makes it easy to pounce when you hear a station you want to work. The transmitter can quickly be zero beat with a received signal by turning its tuning knob while sending a series of very brief dits.

These kits are great confidence boosters for first-time builders. They do work and can provide many hours of on-the-air fun on 80, 40, 30, or 20 meters. Experienced builders will find plenty of room for performance-enhancing mods. Don't hesitate to experience the thrill of QRP with these little kits. For making contacts across town or across the country, these rigs are fun to build and operate. 72!

The Slide-wire Bridge

By Paul L. Conant, Jr., WQ5X
1004 Morningside Drive
Grand Prairie, TX 75052-1634

Do you need a simple, accurate way to measure reactances? This writer ran across a neat device in Drake's Radio Cyclopedia (1931). The slide-wire bridge measures inductance and capacitance. It can be constructed with nothing more than a piece of wood, some screws, hook-up wire, alligator clips, a high-impedance earphone, some resistance wire (i.e. Nichrome), and an audio oscillator.

Fasten a 25" piece of Nichrome wire to a wooden board and make a mark on the board every quarter inch. Number the marks from 1 to 100. The ends of the Nichrome are terminals A and C of your bridge. Connect your audio oscillator to these terminals. Connect your known reactance between terminal C and D, and the unknown between D and A. Connect one lead of the earphone to terminal D, between the unknown and known reactances. Terminal B is the point of contact between the Nichrome wire and the other lead of the earphone. Move it along the Nichrome wire until you detect a null. This is the point at which the bridge is in balance.

The ratio between terminals A and B and terminals B and C, along with the value of the known reactance, are used to figure the value of the unknown component. For measuring inductance, if A-B is 25, B-C is 75, and the known inductance is 100 uH, then 25/75=x/100, and x=33 uH. The ratio is flipped when measuring capacitance. If A-B is 25, B-C is 75, and the known capacitance is 100 pF, then 75/25= x/100, and x=300 pF.

You can construct this simple, but accurate, bridge using any convenient dimensions. You will not find Nichrome wire at Radio Shack, but you might try recovering it from discarded hair dryers or curling irons. Other resistance wires, like Kalvan, can be used, also. You may substitute an audio amplifier, like the Ten-Tec Utility Audio Amplifier kit, that has a high impedance input for the earphone. You can also use your DVM to detect a null along the resistance wire. This simple, low-cost, or no-cost, instrument takes the guesswork out of winding coils and toroids for your QRP projects. Have fun and 72!

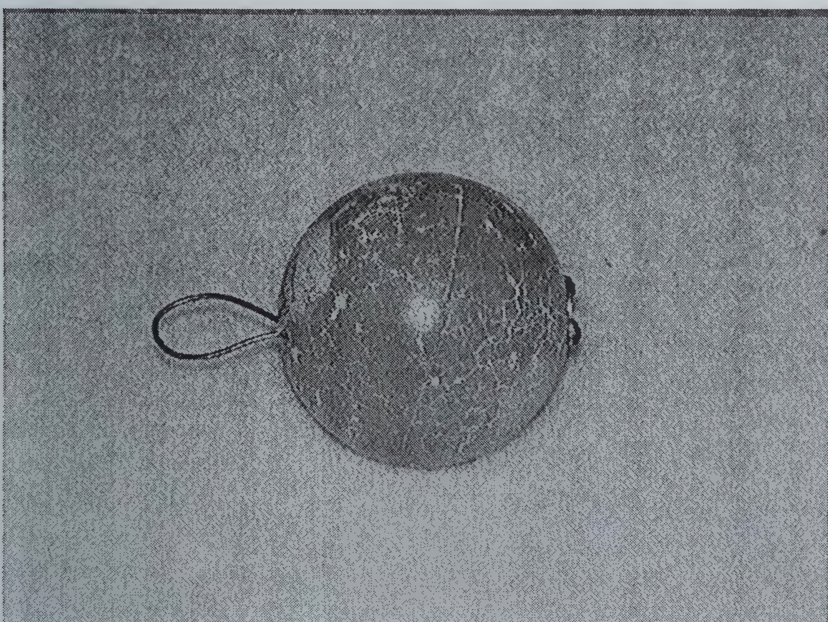
The QRP Rubber Biscuit

by Dave Redfern, N4ELM

The past couple of weeks I've been carrying a radio to work to operate during lunch, kind-of-a QRP lunch bag. The K1 includes the battery pack, tuner, and a 20/17 meter band module for a complete QRP CW station. I also use a KK5PY mini Te-Ne-Key and earphones. The antenna is a 33 foot wire with a BNC on one end. Additionally, I use a 30 foot piece of nylon carpenter's line to help hold up the antenna and have a 16 foot radial wire.

I usually set up on a picnic table next to a moderately sized tree and can deploy the wire as an inverted L antenna with a 16 foot radial. Due to the blustery wind conditions around the building, occasionally I had problems getting the antenna wire over the tree. In the past, I have used rocks or lead weights to pull a line over a tree but this was a semi-public area near the parking lot and I did not want to risk bashing a co-worker, a car, or get a rock and line hopelessly tangled in the company's tree. Also, the landscaping did not include rocks.

I found a possible solution in a box of old dog toys. I came up with



Dave Redfern's Rubber "Biscuit" Antenna Launcher

a 2 1/2" diameter rubber ball. The rubber ball is easy to throw and has enough weight to pull the carpenter's line over a tree. Unfortunately, it is not easy to tie the line to the ball. After several attempts, I could not come up with a way to consistently tie the line to the ball without it slipping off.

Eventually, I decided to push a wire through the ball, make a loop at one end, and attach the wire to a stop at the other end. I used an 8" piece of wire and bent it in half forming a loop at one end. I pushed the other ends through the ball and wrapped them around a ¼" flat washer to keep the wire from pulling back through the ball.

To use it, one end of the line is attached to the loop on the ball; the other end of the line is attached to the end of the antenna and the ball is thrown over the tree. Then with the BNC end connected to the radio, the antenna is pulled over the tree. The line is untied from the ball and then tied off to a nearby bush to complete the inverted L antenna.
The rubber ball can usually be purchased at a toy store or pet store and a visit to the hardware store will get the wire and washer if these items are not in the junk box. Altogether, it should run around $5.00 or less for all new parts.

Dave Redfearn, N4ELM

Parts Scrounging for Fun and Profit!

By: Steve Smith, WB6TNL
1810 McLoughlin Avenue
Oxnard, CA 93035-3441 <sigcom@juno.com>

Consumer electronics items are produced by the millions and sold relatively inexpensively. When a consumer product fails more often than not it is simply discarded rather than repaired, a boon to those of us who enjoy experimenting and homebrewing Ham equipment .

Here are just a few examples of gems that can be found lurking within today's consumer electronics products.

Television sets: Although today's solid-state sets are highly integrated they can still be the source of many usefull goodies. The deflection yoke alone will yield hundreds of feet of small-gauge magnet wire handy for winding coils and for "stealth" antennas. Many transistors can be used as final amplifiers for QRP rigs, at least on the lower bands. Every set has an audio amplifier and speaker, sometimes two, which can be excised for use as utility amps. or in a HB RX. Some sets still use

analog control pots that can be robbed.

VCRs: Many RF parts, especially miniature chokes and capacitors. Older units contain linear power supplies that handle the current requirements of a 5 Watt rig. Also lots of metric hardware. Watch for large ferrite beads & binocular cores in the 300 Ohm to 75 Ohm transformer.

Satellite Receivers: Another treasure trove of R.F. parts. The older 4 GHz receivers are being junked right and left. More coils, capacitors, trimmers, power supplies, broad-band amps -and- if you're real lucky...NE602s! Yup, more than one set I've scrounged has had several. Ooooh!

Cellular Phones: Old analog mobiles have may R.F. plus regulator I.C.s. The handset usually contains a nice audio amp. I.C., speaker and electret mic. Handheld phones have surface-mount parts like audio I.C.s, chokes and capacitors which can be removed and re-used.

Have fun scrounging and by all means: Snort Rosin!

Antenna Analyzer Secrets

by Joe Everhart, N2CX
214 New Jersey Rd
Brooklawn, NJ 08030

Antenna analyzers as sold by test equipment makers like MFJ and Autek are quite popular these days but rather pricey. In this article we will look at the basic ideas behind them and some thoughts on how to roll your own for a very small outlay. In this short piece I don't have space to give any circuits, but I'll point you toward some examples.

The underlying principles are really quite simple. Figure 1 shows the extremely simple block diagram. A tunable oscillator supplies a signal at the frequency where you will be measuring SWR. This supplies a signal to the SWR bridge which, in turn, is connected to the antenna through a coaxial cable. The bridge balance is sensed by a detector and displayed on a meter. In the case of the MFJ units this is an analog meter while the Autek line uses a microprocessor chip feeding an LCD display. Some of the MFJ units and all of the Autek devices provide other information, but that is beyond the scope of this article.

The bridge is the real key to these devices. It consists simply of

several resistors arranged in a modified Wheatstone bridge configuration. Its operation is described in the Test Equipment section of any recent ARRL Radio Amateur Handbook. The bridge compares the antenna impedance to a fixed 51 ohm resistor. A simple diode detector acts as an RF detector across the bridge arms providing a DC output voltage proportional to the bridge unbalance.

There is a very simple relationship between bridge unbalance and SWR. If you want the details check the Test Equi-pent section of the ARRL Handbook but the basics are that the unbalance can be interpreted as the ratio between forward and reflected voltage. Table 1 gives SWR for typical ratios.

Now if you check out a common SWR meter you can see this allows it to be directly calibrated. This same calibration is exactly how the MFJ SWR analyzers display SWR on their meters. And while in common in-line SWR meters you have to manually set the full scale reading on forward power, the analyzers do it automatically. They can do this since their internal oscillators always drive the bridge circuit with exactly the same RF level and that corresponds to a full-scale reading. They do this by sampling the level and adjusting it to always be the same. So then the bridge unbalance displayed on the meter reads directly in SWR with no manual level setting. Not only that, but if they set the meter level high enough that high SWR is above full scale, then the interesting low SWR readings are spread over most of the meter scale.

So SWR analyzer operating principles are really simple. The actual SWR measuring bridge is really a basic combination of resistors and a familiar diode detector feeding a suitably calibrated meter. The difficult part of the whole device is a tunable oscillator that covers a wide frequency range and uses special feedback circuits that sense the output level and keep it constant over the entire tuning range. Plus, it has to have very distortion or they would give faulty SWR readings. Sounds simple but it really isn't! And that's why the analyzers cost as much as they do.

It is 'way beyond the scope of this article to tell you how to do it, but you **can** make an oscillator that covers a narrow range such as one ham band that comes close. And at low frequencies well below the broadcast band you can use special oscillators that do perform over wide ranges. Some examples can be seen on the K0LR web site at http://www.lwca.org/library/articles/k0lr/lfanalyz/lfanalyz.htm.

And you never know, I just may show you how make your own single-band version in a future article...

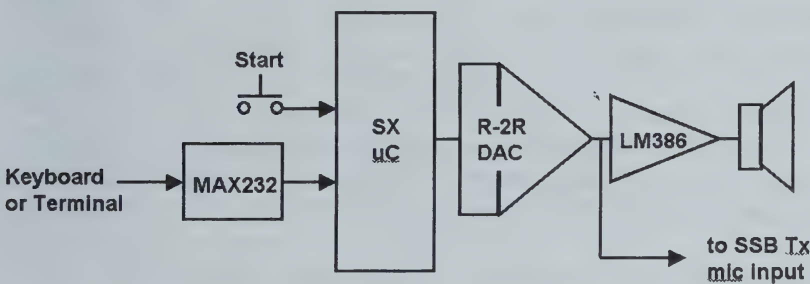
72/73, Joe E., N2CX

Build the PSK31 Audio Beacon

by George Heron, N2APB, email: n2apb@amsat.org
2419 Feather Mae Court
Forest Hill, MD 21050

This small, stand-alone board generates PSK31-encoded audio tones that can be delivered to the input of any SSB transmitter to serve as a PSK31 beacon. When decoded on the receive side, the pre-programmed text string is displayed on the screen of a computer running DigiPan or any other PSK31 software package.

A fast SX microcontroller constructs encoded audio tones using a simple "R-2R" DAC. This audio waveform, generated by using PSK31 algorithms, is fed to an LM386 amp that drives a speaker - *voila*, the familiar PSK31 warble is heard. When presented as input to a PSK31 receiving system such as DigiPan, these modulated audio tones are decoded and the pre-programmed beacon string is displayed as text on the computer screen. The beacon string may be played a single time by pressing a pushbutton, or it may be jumper-selected to play continuously. Other jumpers select which of the 24 different audio carriers are to be used. A keyboard or data terminal can provide input of real-time textual data to the PSK31 Audio Beacon, allowing the project to serve as a more dynamic "signal generator" , and the board can be electrically connected to the input of an SSB transmitter to be used as an RF PSK31 transmitter.



PSK31 Audio Beacon – Block diagram

The Beacon is also ideally suited for groups wishing to have some fun during meetings. Club members could operate their audio beacons while others attempt to copy the beacon strings using a laptop equipped with DigiPan software. Construction is straightforward and you'll have immediate feedback on how it works when you plug in a 9V battery and

speaker.

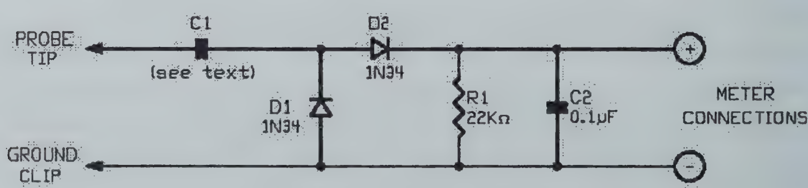
NOTE: The PSK31 Audio Beacon project was described in great detail in August 2001 QST. A complete description, schematic, board layout and source code can be found at http://www.njqrp.org/psk31beacon, and a complete kit of parts is available for $25 from the NJQRP.

An Improved Diode Probe Design

By Dave Fifield, AD6A

Many of you constructors/tinkerers will have used a simple diode probe to test for the presence of RF signals in your newly built homebrew/kit radio. Several kits have single diode RF probe circuits built into them to make life easier for the constructor (for example, the Wilderness Sierra and the Red Hot 20). However, all of these RF diode probe detector circuits suffer from the disadvantage that they are only half-wave rectifiers. As such, they are only about half as sensitive as they could be.

With the addition of another diode, most of these half-wave detectors can be converted into full-wave detectors with a subsequent boost in sensitivity. The circuit of a simple full-wave diode probe RF detector is presented below. This is about as simple as you can make it. For HF use, the input capacitor (C1) should be 100pF. For VHF, make it 10pF. The GND clip lead and the input probe lengths should be kept to a minimum for best performance and minimum affect on the circuit being measured. Although for best sensitivity the use of a modern digital multimeter to measure the DC voltage at the output of the detector is best (as they have a very high input resistance) for most ham applications, such as tuning up a transmitter bandpass filter, it is much easier to use an analog multimeter. If you do use an analog meter, make sure it is a good one with an input resistance of at least 20KOhm per volt otherwise the diode probe sensitivity will be too low to be of any use.



Note the use of germanium diodes in the diode probe circuit. These have a forward voltage drop of about 0.3V. The use of silicon signal diodes is not recommended (e.g. 1N914, 1N4148) as they have a much higher forward voltage drop of about 0.7V. If you can find them, feel free to use some Schottky barrier diodes (or hot carrier diodes as they are sometimes called). These have a forward voltage drop of only about 0.2V or 0.25V depending on type.

Of course, there are other improvements that can be made, such as the inclusion of an op-amp to remove the diode's forward voltage drop and linearize the output. These can be the subject of another short article in a future edition of QRPp.

QRPifficciency

By Brad Mitchell
N8YG (Formerly WB8YGG).

Some time ago I was reading the milliwatt re-print that I had ordered, and was very much interested in the ongoing discussion between many names like Jim Cates, and Wes Hayward regarding The defacto means of measuring power for QRP.

The debate surrounded the idea that the traditional Input Power measurement was not valid for doing things like miles per watt etc. It seems that there were lines in the sand drawn, but the Pout measurement prevailed.

Time went on and my day job got very involved with designing the power system for a portable digital camera at Kodak. I used the latest technology for designing the camera's power system so that it would be cost and power efficient. I of course used switching regulators for any relative high power systems in the camera.

This experience started a chain of events in my thought process. First why do we never see switching power supplies used in QRP rigs so that we can operate from multitudes of voltages input to the rig, with high efficiency conversion? I know that the old noise excuse is no longer valid with the latest technology!

And finally I started thinking why don't we specify the power conversion efficiency of QRP rigs?

This made me think for a moment that if we had not dropped the Input Power measurement as the standard for measuring QRP rigs, we may have forced more efficient designs!! This was almost enough in my mind to start up the original Milliwatt debate of Power input vs Power output for Miles per watt etc.

What I propose is that we not reinitiate the debate of Pout vs Pin ,

as I believe it probably is counterproductive, but to encourage a specification for power conversion efficiency for QRP rigs. There are many cases where we see the specs for receiver current draw, but I believe that we should look at the specs for the Tx efficiency, across the full battery input voltage for the radio as well.

What this would mean is that we could come up with a conversion efficiency for a rig at 14V when the battery is new, and then one for say 05. v increments, down to the useful operating voltage of the rig. This information would be very useful to those that would like to operate QRP portable, and I believe that there are many. It would certainly help predict the number of batteries necessary, and if we started using such a standard, we might actually encourage more efficient designs in the future.

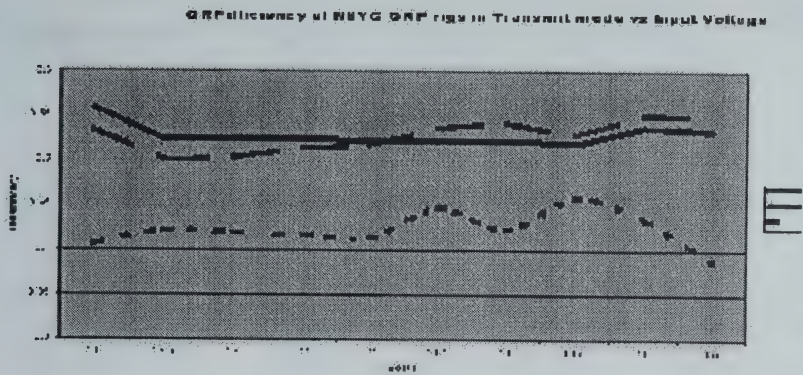
For example if someone came out with a rig that had all the bells and whistles in it, synthesized, fit in an altoids tin, only drew say 10 mA in receive mode, and put out 5 watts on all bands, we would all want one. But alas maybe it really is quite inefficient in transmit mode, and would be a great conversation piece in the shack, but not so great for the field. (unless you just listen). More efficient designs would lead to less batteries required to drag along into the woods for operating QRP. Now.. who doesn't want that?

As a simple test I took 3 of my portable QRP rigs, and did a simple test from 14 volts down to 9 volts input.

The chart shows the QRPifficiency of each of these rigs over the range of voltages that I used. The data for each of the rigs is shown in the 3 tables. The QRPifficiency ranges from 38% to 55% Realistically these figures are very poor as far as general efficiency numbers are concerned. How good are they relative to the rest of the rigs? Only time and further testing will tell. The challenge is set to come up with the most QRPifficient design.

By the way.. My Sierra, is highly modified, the 38S has the high power mod, and the SW-40 is not modified at all.

Brad N8YG



Sierra

Vin	I in	Pin	V p-p	Pout	Qrpifficiency
14	0.77	10.78	48	5.76	0.53
13.5	0.75	10.125	45	5.06	0.50
13	0.74	9.62	44	4.84	0.50
12.5	0.72	9	43	4.62	0.51
12	0.71	8.52	42	4.41	0.52
11.5	0.68	7.82	41	4.20	0.54
11	0.67	7.37	40	4.00	0.54
10.5	0.65	6.825	38	3.61	0.53
10	0.62	6.2	37	3.42	0.55
9.5	0.62	5.89	36	3.24	0.55
9	0.6	5.4	34	2.89	0.54

38s

Vin	I in	Pin	Vp-p	Pout	QRPifficiency
14	1.15	16.1	60	9.00	0.56
13.5	1.15	15.53	57	8.12	0.52
13	1.11	14.43	55	7.56	0.52
12.5	1.07	13.38	53	7.02	0.52
12	1.04	12.48	51	6.50	0.52
11.5	1	11.5	49	6.00	0.52
11	0.96	10.56	47	5.52	0.52
10.5	0.93	9.77	45	5.06	0.52
10	0.9	9	44	4.84	0.54
9.5	0.87	8.27	42	4.41	0.53
9	2.64	23.76	0	0	0

SW-40

Vin	Iin	Pin	Vp-p	Pout	QRPifficiency
14	0.32	4.48	27	1.82	0.41
13.5	0.32	4.32	27	1.82	0.42
13	0.31	4.03	26	1.69	0.42
12.5	0.3	3.75	25	1.56	0.42
12	0.29	3.48	24	1.44	0.41
11.5	0.28	3.22	24	1.44	0.45
11	0.26	2.86	22	1.21	0.42
10.5	0.24	2.52	21.5	1.16	0.46
10	0.23	2.3	20	1.00	0.43
9.5	0.22	2.09	18	0.81	0.39
9	0.2	1.8	18	0.81	0.45

Test equipment That doesn't cost a mint!

By Tony Fishpool G4WIF/K4WIF

My favourite part of Radcom is Pat Hawker's "Technical Topics" column. Recently, he mentioned a new chip - the LTC 1799 that can generate square waves over a wide frequency range and more or less, left it at that – but I was intrigued. I managed to scrounge a couple out of Linear Technologies. The LTC 1799 is intended for clock applications on a preset frequency.

The fixed resistor allows selection of any frequency between 1KHz to 30MHz. So got to thinking – why not a variable resistor?
The frequency is determined by the following formula:-

$$F = \frac{10^3}{N.R}$$

Where N is the division factor and R is the resistor value.

As the frequency is inversely proportional to resistance the upper limit is not affected by choice of potentiometer but the lower frequency will be. A ten turn pot with a value of 20k turned up in the junk box. This resulted in a swing of 4 to 30 MHz in the "divide by 1" position. The tuning was rather course so a 100 ohm pot was added in series for fine adjustment. Stability was surprisingly good and at 30 MHz only the kilohertz digit tended to wander. I wouldn't claim this to be a signal generator – more an adjustable marker generator. It would certainly fit in a

mint tin but I added a frequency counter to make it more useful. The datasheet does warn that the resistance should not fall below 2.2K so a fixed resistor was also added in series with the potentiometer.

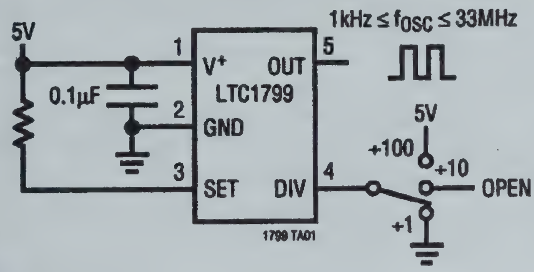


Fig. 1

Construction.

The LTC1799 is a SOT23 surface mount chip. It is very tiny and conventional construction methods become quite a challenge. Ted Williams G0ULL is a master at producing surface mount PCBs using photographic methods. It's not rocket science when you have the equipment and Ted has been commissioned by KI6DS to write an article on the subject for QRPp. I used the superb ARES software to design a board and e-mailed it to Ted who quickly sent a pcb back via "r-mail", (my wife Ruth is second clarinet in Ted's orchestra!). The board was less than an inch square and I used some double-sided tape to fix it to a piece of copper board. Using skills obtained from building the SMK-1 (and a large magnifying glass) I positioned and soldered the chip, then the rest was plain sailing as I tacked wires to the pads (see Fig 2) and

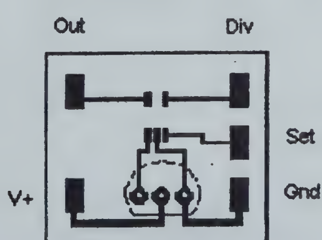


Fig. 2

mounted the other components “ugly style”. I used a 5 volt regulator (which you can see on the PCB) to ensure that the LTC 1799 didn’t get fried. It will work from 2.2 volts to 5.5 volts.

Performance.

At frequencies below 14 MHz the circuit is remarkably stable but as you get closer to 30MHz it will start to wander around 2 to 3 kHz. Aside from the chip just getting close to it’s maximum, I think it had a lot to do with the quality of potentiometer used.

Refer to Fig 3. The graph shows how little change in resistance at the high end results in quite a large frequency swing. This had led me to want to play with digital potentiometers as there will be the very predictable resistive steps - perhaps that will spawn another article? To save my poor brain as I sorted through the junk box and found 10 turn pots with different resistances, I constructed an Excel spreadsheet so I could calculate the upper and lower frequency each would give. I can email it on request to anyone who wants to experiment further.

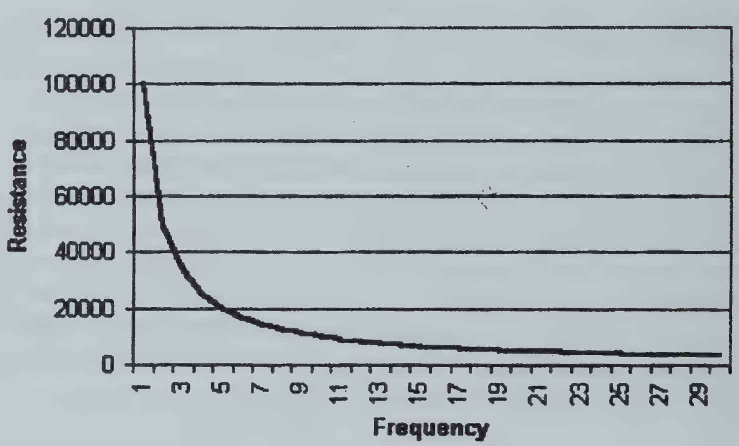


Fig. 3

Test equipment

That doesn't cost a mint!

By Graham Firth G3MFJ/W3MFJ

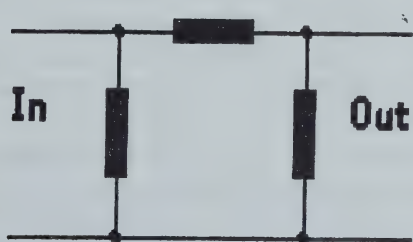
Part 4 – An Attenuator

Hi again. This is the fourth part of my series of articles on simple test equipment. It's yet another piece of kit that I described at Pacificon in 2000, and also at Atlanticon & Arkiecon in 2001. This is another example to show that test equipment does not have to be complicated to be extremely useful.

This is a very simple circuit, but looks a little more complicated because it is repeated a number of times. Like the noise generator I described in the last issue, the circuit is taken (with minor changes) from the ARRL handbook of a few years ago. It's amazing how many simple test equipment circuits are around if you look for them!

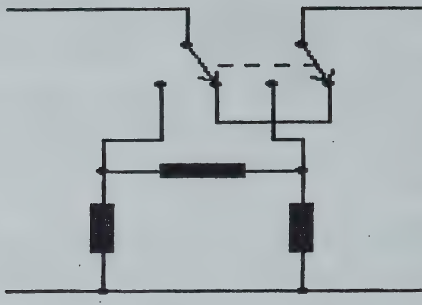
Each stage of the attenuator attenuates the signal by a fixed amount. At one end of the complete attenuator, each stage attenuates by a small amount, and at the other end, by a large amount. Each stage has its own switch and any value of attenuation – up to the maximum - can be set by operating the appropriate switches.

The basic circuit of a stage of the attenuator uses three resistors thus:

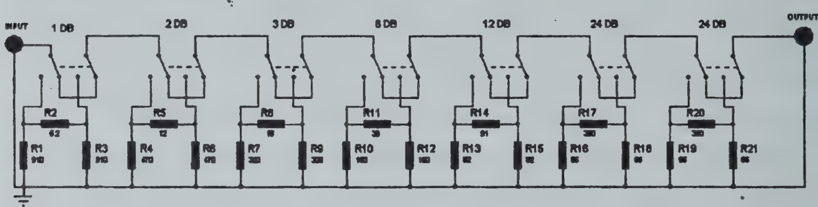


The values of the three resistors are chosen to give both the required attenuation, and the required impedance such as 50 ohm. This means the stage can be inserted into an antenna circuit and not change the matching.

If a switch is added:



Each stage can then be switched in or out as required thus: The circuit of the completed attenuator is now:



The values of the resistors in ohms are:

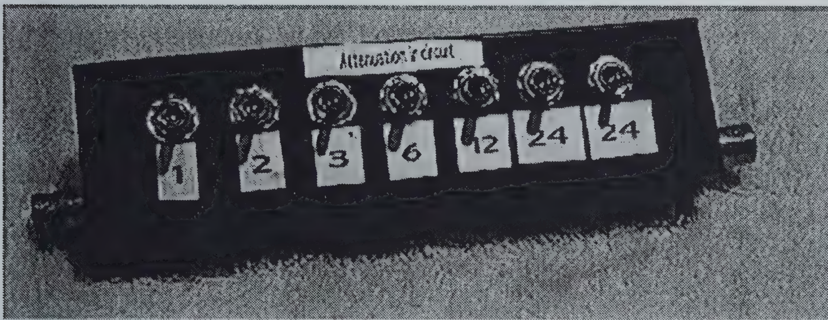
R1 R3	910	R2	62	Attenuation – 1dB
R4 R6	470	R5	12	Attenuation – 2dB
R7 R9	300	R8	91	Attenuation – 3dB
R10 R12	150	R11	39	Attenuation – 6dB
R13 R15	82	R14	91	Attenuation – 12dB
R16 R18	56	R17	390	Attenuation – 24dB
R19 R21	56	R20	390	Attenuation – 24dB

These are all preferred values from the E24 range and because of this, do not give the exact attenuation value, but are all within 10%.

This circuit is really intended for receiver testing in conjunction with a noise generator, or signal generator. However, for the dedicated QRPp enthusiast, providing the resistors are rated appropriately, it can be used with a transmitter to give milliwatt or even microwatt outputs! Don't forget that the resistors have to dissipate the unwanted power

I built mine in a box made from scrap PCB and covered in "sticky-backed plastic" to disguise this!

Here is the completed attenuator with BNC sockets at each end:



Either end can be the input or the output.

That's it for this time – see you in the next issue of QRPp

Shiny Teeth, Cheap Knobs

by Michael A. Gipe K1MG
12770 Lika Ct
Saratoga, CA 95070

OK, I'll admit it. I've had an obsession with knobs since I was twelve years old. I would pull out the Sears catalog late at night in the privacy of my room, and flip quickly through the pages – past the men's sportswear, past the ladies' winter coats, until I reached all those wonderful models with the *knobs*. S38, HQ180...the whole *Hallicrafters* line of receivers and transmitters was there, and every one of them was covered with knobs! I dreamt of having one of those receivers of my very own to tune and turn and twist until Uzbekistan came in like the BBC. Since then, knobs have continued to be a special part of all my construction projects. No common Radio Shack or Mouser knobs would do for *my* homebrew radios; the knobs had to be *special,* often homemade. Here is one of my tricks for making cheap and easy knobs.

First, collect the raw materials by saving the caps from toothpaste tubes, ointment tubes, and *Jif* peanut butter jars. When modified to hold a control shaft, these make great knobs. Toothpaste knobs come in attractive colors, are just the right size for diminutive QRP rigs, and have good non-slip ribbing. The caps from my favorite brand, *Tom's Toothpaste*, even have a recess on the top to fit a second stacked knob for dual controls, just like on a *Tektronix* scope. For the top knob, a cap from an ointment tube is usually a perfect fit. The *Jif* jars have a nice large plastic top with ribbed sides that is great for main tuning dials or large antenna tuner knobs. Once you have collected your raw materi-

als, clean them thoroughly and dry.

Next you will need to purchase some casting epoxy, available from plastics stores, auto parts stores, and crafts stores. Place the collected caps on a level work surface with the inside up. Mix up a batch of epoxy, and carefully pour it into the caps until it reaches the very top edge. Avoid air bubbles. Let the epoxy harden for at least a day – it needs to be very hard for the next step, which is to drill a center hole for the control shaft. Standard sizes for shafts are ¼", 6 mm, and 1/8". Select the drill to match the control you will be using the knob on. Next drill a hole from the side of the knob through to the center hole for a setscrew. Allen head setscrews can be purchased from local hardware stores and mail order companies such as Digikey. Tap the side hole, insert the setscrew, and you have a custom knob! If you don't like the color, you can paint the knobs with a couple coats of *Krylon*. Twiddle to your heart's content.

Honey... The Dog Ate The Krazy Glue!

By Darrel Swenson, KØAWB
327 N. 153rd Circle
Omaha, NE 68154

This tale won Doug Hendricks' award for the "Ugliest Story" at ArkieCon 2001. (I think Doug was just being kind... and didn't want to call my "Manhattan Construction" attempt UGLY!)

While working on my IA-QRP10 this last winter I decided to remove a couple of pads and reposition a couple of components. Two or three minutes later when I was ready to glue down the pads, I was unable to find the glue! Apparently when I removed the pads, the small plastic tube of "Krazy Glue" rolled off my work bench and onto the floor.

Our best guess is that my wife's PRIZE Shetland Sheep Dog ('Sheltie'... her hobby...!) wandered into my shack, spotted the glue under my chair, thought it was a treat, and "wolfed it down."

After a trip to the 'doggie emergency room'... x-rays... a phone call to the glue manufacture... a phone call to the poison control center... a trip to the regular vet... and more x-rays... the dog is OK. According to the people that make the glue... the good news is the glue is not toxic... the bad news is it is not stomach acid soluble.

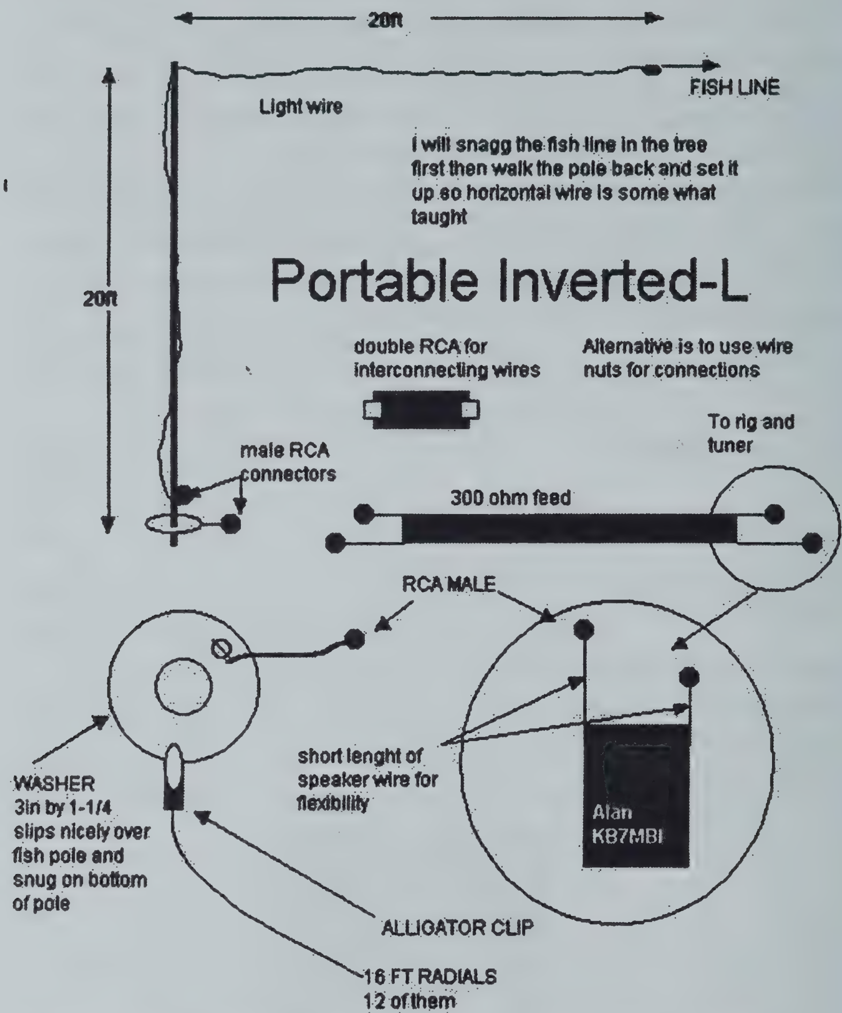
My wife's little puppy lucked out. His tummy was full of dog food from supper. When I looked down, he must have thought he was going to get in trouble, so he swallowed the tube whole instead of chewing on it. Two days latter he 'passed' a small chunk of dog food glued together in the size and shape of the plastic glue tube.

Dogs are not covered under health insurance... so my billfold is a LOT LIGHTER... (about the price of a K2!) But the dog is OK. He went on to win 1st and 2nd place at several dog shows this summer.

72... Darrel, KØAWB

Inverted L Antenna

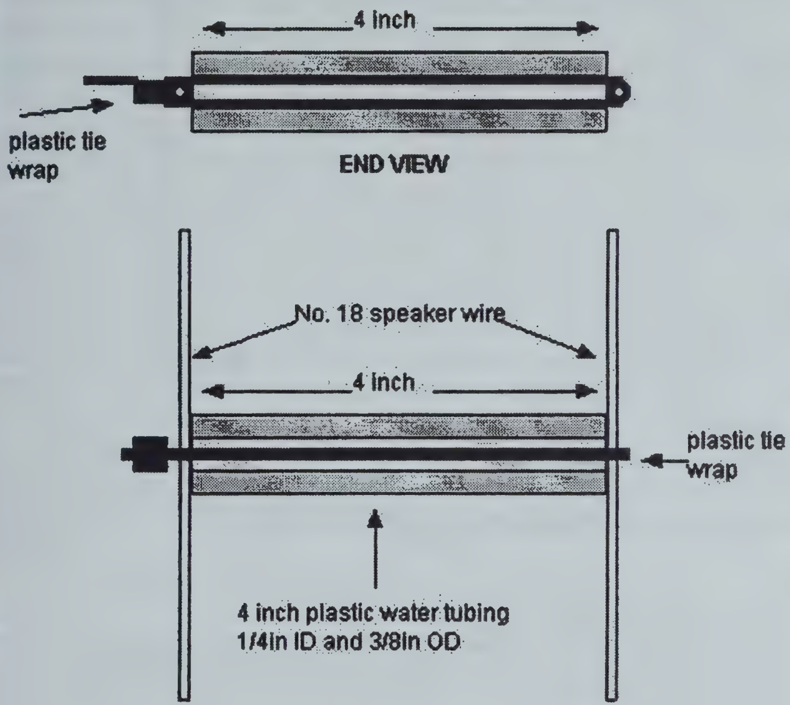
by Alan Dujenski, KB7MBI



Pole is supported in several ways. I have one of those spuds that stick into the end of a paint roler and the other end screws on to a short paint roller extension handle. I drive the handle into ground and screw on spud and slip pole end over spud. For snug fit I put a few wraps of electrical tape on the spud. Also you can guy at about 4ft level and rest pole on ground or bungy cord to a post or other handy item

Quick & Easy Ladder Line

by Alan Dujenski, KB7MBI



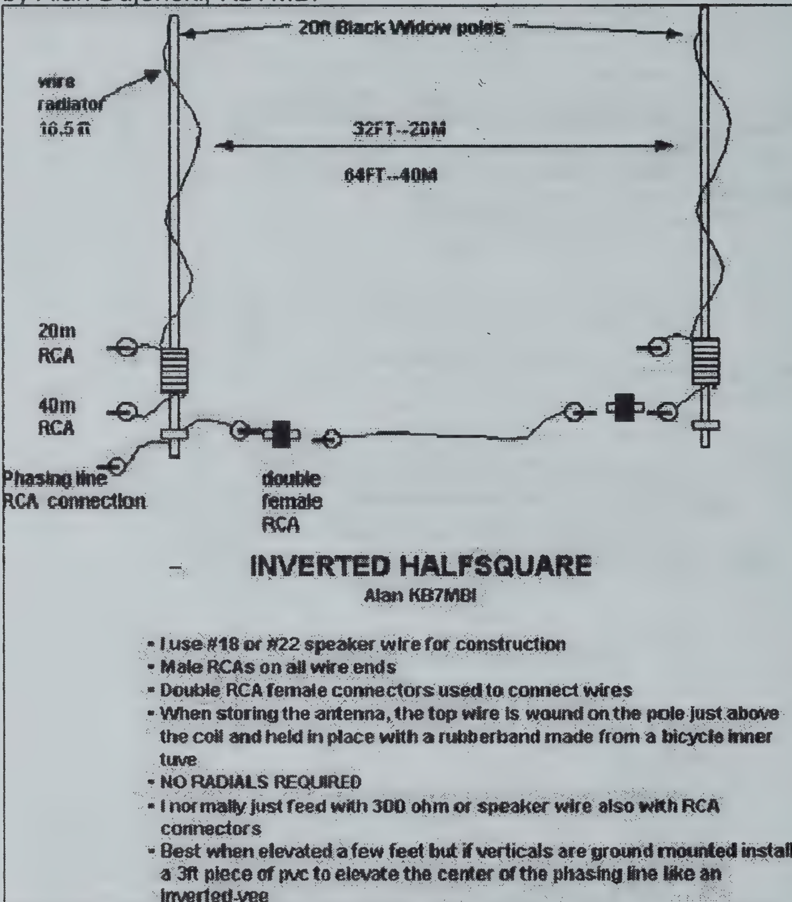
Quick Ladder Line

Pass the plastic tie wrap thru the tubing and around wire and feed back thru and wrap around other wire. Cinch tight. Space as needed--about 16" to 18".

Alan KB7MBI

Inverted Half Square Antenna System

by Alan Dujenski, KB7MBI



I use #18 or #22 speaker wire for construction
Male RCA's on all wire ends
Double RCA female connectgors used to connect wires
When storing the antenna, the top wire is wound on the pole just above the coil and held in place with a rubberband made from a bicycle inner tube.
No Radials Required
I normally just feed with 300 ohm or speaker wire also with RCA connectors
Best when elevated a few feet but if verticals are ground mounted install a 3 ft. piece of PVC to elevate the center of the phasing line like an inverted vee.

Twinlead Dipole for Portable Operation

by Dave Benson, K1SWL

Over the past few years, I've been on a number of portable HF, and the antennas have always posed a challenge. At worst, I recall a make-shift vertical antenna where we tripped over the ground radials several times and dragged the rig off the operating table. That outing truly illustrated an old scientific maxim: "No experiment is ever a complete failure- it can always serve as an example!"

As a result, my patience for having extra equipment along- tuners and SWR indicators- is diminishing. For the past several years, I've been using an RG-174-fed dipole connected directly to a rig. While it works well enough, I'm not happy with the thought of giving away several dB of line loss. The antenna described in this article approaches the problem differently. While it's a single-band approach, for me the tradeoff is a good one in terms of operating convenience.

The antenna consists of a 300-ohm twinlead dipole and feed line. The dipole length uses the standard formula, and the twin lead wires at the dipole-ends are connected together. The feedpoint impedance is quite close to 300 ohms, so a twin lead feed line of arbitrary length may be used.

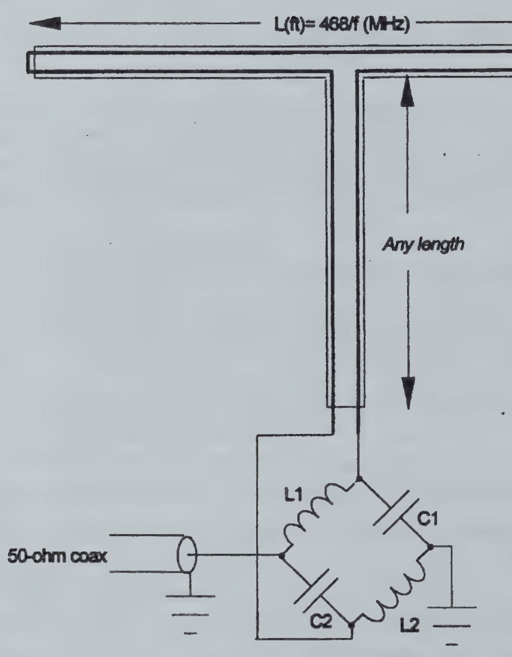
The antenna I've just described is inherently balanced. I considered a 1:1 balun and matching network and put it aside when I found the circuit shown below. It combines both balun conversion and impedance-matching functions in one. Each L-C pair in this bridge is calculated as an L-network, in this case for a conversion from 50 to 300 ohms. I take no credit for this circuit- it was described to me by Wade Holcomb, W1HGU. He noted that it had appeared in the amateur literature in the late '50s, but the specific reference was unknown. *Use good quality (NPO/C0G) capacitors for this.*

The matching network is constructed on a 1" x 1.5" piece of circuit board. I used one half of a 6-foot RG-174 BNC cable (Jameco Electronics) as a transition to a transceiver. I strain-relieved the RG-174 with a short length of shrink-tubing (necessary to increase its outside diameter) and clamped it to the circuit board with a 1/8" nylon cable clamp. At the other end of the circuit board is a pair of wing nuts for connecting the feed line to the network. Because the feed line length is arbitrary, this line may be cut to length once the antenna's up, stripped and attached. If you have a more permanent setup in mind, it might be practical to clamp the feed line to the board with a washer and hardware and then solder it directly to the board. I sleeved the circuit board

with a length of 1" shrink-tubing to improve the circuit's durability under field conditions. *Also a good idea- a piece of scrap plastic pressed into service as a center insulator/strain relief at the antenna's center. I drilled a trio of 1/8" holes through the twinlead and corresponding holes through the scrap and used #4-40 nylon fastening hardware.*

As evaluated at my home station with a temporary antenna up about 25', SWR measured 1.1:1 or less across a 200 Khz slice of 20 Meters. I used this antenna during last September's QRP Afield outing. I'd love to report the field results- I did have an SWR meter along for curiosity's sake. *Naturally, one of the interconnect cables failed, thus neatly proving my point about extra doodads!*

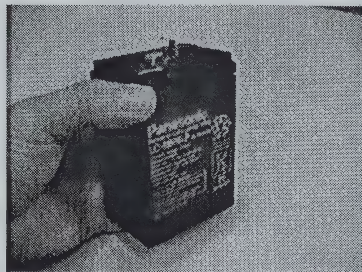
When it's time to pack up your operation and hit the trail, this antenna can be wadded up and stuffed into a backpack. So, for that matter, can a wire dipole, but your chances of untangling and reusing the wire are pretty slim- the twin lead lends itself nicely to being unsnarled and reused.



(values shown for 20M)
L1, L2= 1.27 uH 18 turns T37-2
C1, C2= 82 pF NPO

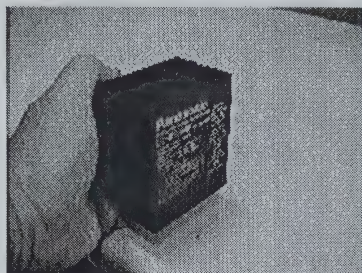
RECYCLE A DEAD GEL-CELL INTO A QRP CABINET

By Bill Jones – KD7S
83 Redwood Avenue
Sanger, CA 93657



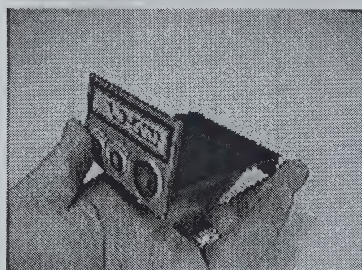
STEP 1

Cut the top off a dead gel-cell. Dispose of the insides properly. Use caution when handling the cell material. There is no liquid inside but the paste can be very caustic. Wear gloves and eye protection.



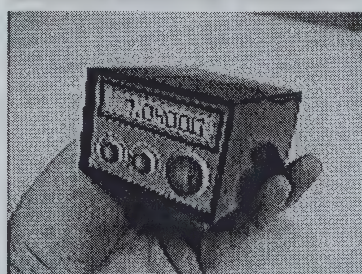
STEP 2

Wash the case out with soap and water. Remove the partitions with a pair of sharp scissors, side cutters or even tin snips. Use long nose pliers to the partitions from the bottom of the case.



STEP 3

Use a file and some sandpaper to smooth the leftover edges of the partitions. Use more sandpaper and some fine steel wool to remove the writing from the outside of the battery case.



STEP 4

Make front and rear panels and a chassis from ABS plastic or double sided PC board material.

STEP 5

Finish the cabinet with a little black paint or auto polish. Add stick-on rubber feet and computer generated labels and you have a great little cabinet at little or no cost.

Rig and Antenna Connection Switching - Simplified

by Bill Lazure W2EB
141 Kendall Dr. West
East Syracuse, NY 13057

I run 8 separate antennas, have 4 rigs at my operating position, and use a large variety of antenna testing/tuning devices. Switching between all of these devices was pretty tough. The cost of commercial antenna switches seemed high considering I would need a few of them! To solve this problem, I borrowed an idea from the commercial RF world...I made a Patch Panel.

I built a box out of fiberglass panels in a wood frame. I obtained the fiberglass by stripping the copper off of heavy copper-clad PCB material. The box dimensions are about 16" wide by 5" high by 6" deep. On both the front and rear panels, I drilled two rows of 12 holes, one row over the other. The front panel is for the patch cable connections, and the rear is for the equipment connections.

I then made the internal connecting cables using RG-58 and crimp Bulkhead panel-mount BNC connectors. I mounted one connector on the front panel, and the other on the corresponding hole on the rear of the panel. I chose BNC connectors because of their constant impedance, easy connect/disconnect, secure connection, and common availability.

While I wanted all of the "patch" connections on the front panel to be BNC, I needed some UHF connectors on the rear for antennas. I couldn't find any inexpensive shielded UHF bulkhead connectors, so I simply soldered the cable onto the connectors as you would within a rig: center conductor to center pin, and shield to lug on mounting screw. Additionally, If you need other connectors for your equipment such as RCA jacks, or ¼" jacks, place these on the rear panel and connect to a corresponding BNC jack on the front.

I then connected all of my rigs, antennas, and test pieces to the rear panel connectors, and made up 6 patch cables. The patch cables were about 18" long with BNC plugs on both ends.

Operation is a breeze. On the front panel, simply run a patch cable between a rig's BNC connector, and an antenna's BNC connector. If you need a SWR meter in line, run a patch cable from the rig's connector to the SWR meter's input connector, and another cable from the SWR meter's output connector to the antenna's connector. Want a tuner as well? Simply insert it after the SWR meter by using more patch cables.

Patch panels like this can also be used for Audio, Keying, and even Mic connections.

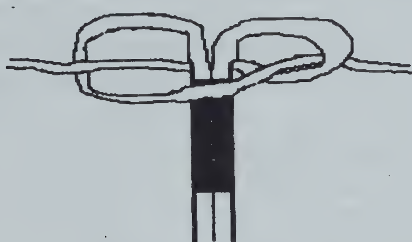
My Favorite Trail Antenna

By Murphy (Sandy) Chesney, KB3EOF
7220 Burkittsville Rd
Middletown, MD 21769

Backpacking with a ham radio is a great way to connect with the great outdoors without leaving your other favorite hobby behind. It can also save your life if you get lost, hurt, stranded or caught in bad weather. Nobody wants to burden themselves with a heavy setup on the way to the outback. So, here is the setup that fits in my backpack and leaves room for food, raingear, water and all the other goodies you need for an overnighter.

Antenna:

A 40 meter half-wavelength dipole with its own built in feedline is perfect for this purpose. RadioShack sells a 60-ft spool of 18 gage speaker wire for a few bucks that is ideal but plain old zip-cord will work as well. Measure off 234/7.04 = 33 ft, 3 inches of speaker wire and mark it with tape, but don't cut it. Now split the end and pull the two strands apart all the way to the tape to form the full 66 ft, 6 inch dipole. Reinforce the center feedpoint with duct tape wrapped around for a sturdy T and further keep the strands from pulling apart by tying an



electrician's knot at the juncture (see figure). Now you have about 30 feet of feedline left that you can terminate with two banana clips. This will fit into 5 way binding posts on your balanced line tuner or 4:1 balun. Coil the feedline and two legs of the dipole, secure with twist-ties, and you have a lightweight antenna that works like a dream and can be shoved with impunity to the bottom of the roughest rucksack.

Deployment:

I use an SD-20 collapsible fishing pole both as a walking stick and to support the center of the dipole. Find a location with two sapling trees about 50-60 feet apart and a stump or something you can tie the SD-20 to in the center. Grab a sapling and bend it over until you have

the tip of the tree to which you attach one end of the dipole. Let the tree spring back up and *Eureka* instant dipole end deployment up 15 feet or more. Since the wire is insulated I just tie it to the tree directly and all is well. Repeat with the other end and then prop up the center with the SD-20 fishing pole/walking stick. The process takes about 5-10 minutes and gives you a nice flat top or mildly inverted V up about 20 feet. The feedline dangles to the ground with enough to spare to comfortably set up your rig and tent in a good spot.

Matching and Performance:

Zip cord type antennas have an impedance of about 105-ohms and attenuate about 1.7 decibels per 100 ft at 7 MHz (See Zip-Cord Antennas- Do they Work? by K1TD from QST, March 1979). That means with a 30 foot feedline you have about 0.5 decibel loss, which is not discernable at the receiving end. I have found that a 4:1 balun from LDG will give me 1:1 SWR over average ground with this setup, but my favorite method of matching is with the NorCal Balanced Line Tuner (BLT) by W6JJZ. This tuner fits in the palm of your hand, requires no external power, and is available in kit form from the NorCal web site. The antenna tunes up easily, and with my NorCal 40A putting out 1.5 watts I can easily work CW stations up and down the East coast during the day. Forty meters is almost always open and away from civilization the signals come flooding in clear as a bell with this antenna. Higher frequencies start to have higher loss with this feedline but it is difficult to ask a DX station to dial 911 for you anyway. For 40 meters this is all the antenna you need for that end of the trail rag chew or fast call for help.

My Favorite Trail Power Supply

By Murphy (Sandy) Chesney, KB3EOF
7220 Burkittsville Rd
Middletown, MD 21769

Picture this: You and your hunting buddy have been dropped off on a pristine lake in the Alaskan wilderness by a float plane. After a week of glorious hunting, fishing, and camping, the plane is supposed to come back to return you to civilization, but NO PLANE! Batteries that were fully charged at the beginning of the trip are now flat and your trusty ham radio sits there without juice. No problem, you whip out your portable, lightweight, solar powered DC power supply, switch it on and presto, you have 12 reliable volts of DC power. After using it to power up your GPS and record your precise location, you plug in your QRP radio and ask a ham in Anchorage to pass along a message to your

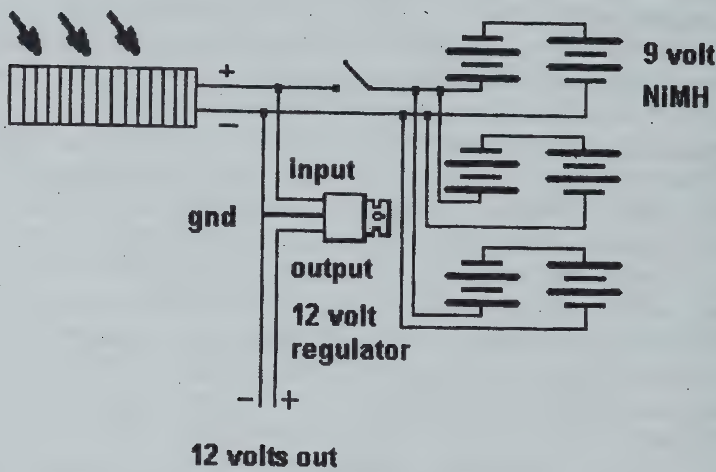
family for another float plane. You do have an emergency man-portable solar powered supply, right? Something that will fit in a side pocket of your pack, right? If the answer is no, fear not, here is a lightweight power supply your back will love.

Materials: Solar battery charger of the type used to trickle charge a car battery. ICP makes one called the BatterySAVER PLUS that is about a foot long, 4 inches wide and 1 inch deep for around $30 (RadioShack cat # 980-0561). But watch RadioShack or Harbor Freight Tools as these or similar items often go on sale for $10 or less. It puts out about 125 mAmps at 15 volts in direct sunlight, not enough to overcharge your battery but at 1.8 watts not a bad source for a QRP transceiver. For batteries use six 9 volt rechargeable NiMH. A 12 volt DC voltage regulator, #276-1771, in a TO-220 case hangs on the wall of your local RadioShack, plus a small slide switch, several (maybe 10) feet of speaker wire, six 9 volt battery connectors and a male power plug of your choice. Make sure the plug fits your QRP rig.

Construction: The first thing I did was (*Warning, this may invalidate your warrantee, HI HI*) unscrew the back and remove that annoying blinking red LED these manufacturers seem to think is cute, leaving in the blocking diode. Remove the power cord and save it for a project that needs a cigarette plug and cord. Test your panel in full sunlight to make sure you have near 20-24 volts DC unloaded. Wire it as per the diagram with the slide switch outside and the voltage regulator inside the solar panel. The ICP BatterySAVER PLUS has a nice power cord mono plug receptacle you can use, or drill a hole and knot the cord just inside the panel. You will need a separate hole and cord for the battery pack. You could put everything outside, I just prefer the security of the regulator snug inside the panel. Not one for fancy enclosures, I used a strip of duct tape to put the 6 batteries in a row on the back of the panel and wrap the power cord around the panel for storage. Since NiMH 9 volt batteries can get expensive, I scrounged and put a Frankenstein mixture of old and new NiMH and NiCAD batteries together so I didn't have to shell out $60 for all new batteries. I can hear the purists scream about mixing NiCAD and NiMH but the thing has worked flawlessly for me in the field for almost a year.

Operation and Performance: A typical NiMH runs at 7.2 volts. Two in series will run 14.4 volts and when charged with the above solar panel they will go over 15 volts, a tad high for most QRP rigs. The low drain 12 volt regulator brings the voltage down to a happy range for the rig while the batteries continue to see whatever the solar panel can dish out. Three of these paired batteries in parallel will give you 450 mAH in the dark, not a bad source for a 1 or 2 watt QRP rig. Of course, in full

sunlight you get indefinite receive time and much extended transmit time. I have full power when the panel is in direct sunlight even after a couple of hours of listening and sending the day before on my NorCal 40A running 1 watt CW. When not charging I turn the switch off to prevent a slow discharge of the batteries through the regulator. This arrangement may not last for an all day contest style event but it would last for a good part of it, depending on the clouds. You could always add more battery pairs in parallel for more capacity, but I have never exceeded the need for 6 in the field. That keeps the weight down to just over 1 pound. For a few casual daily contacts and listening to the mail this power supply will keep you going indefinitely on the trail.



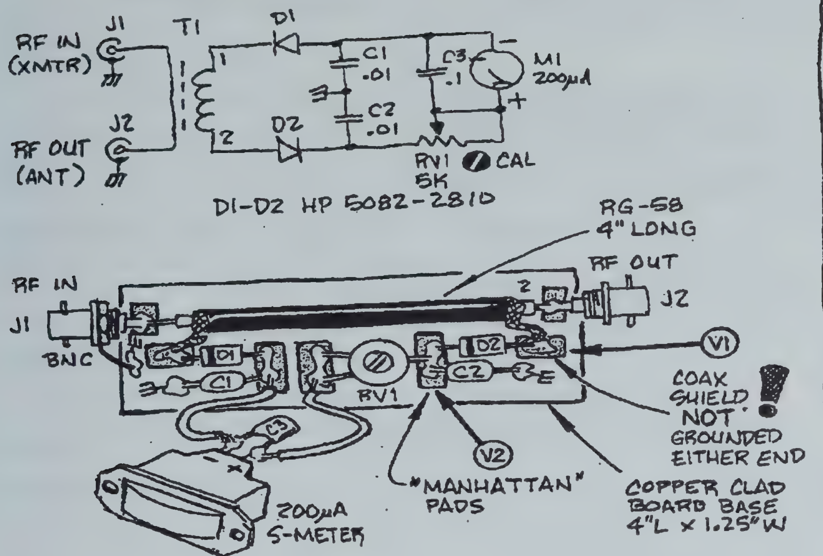
A Prototype Power Meter, A Work in Progress

by Paul Harden, NA5N

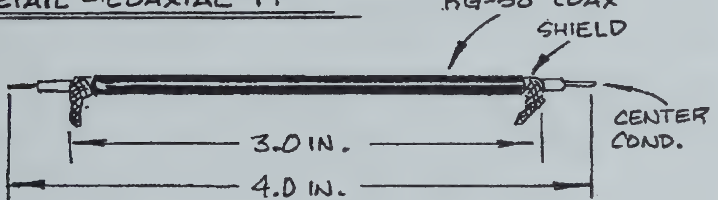
[This article was originally published in the November 2001 issue of the Peanut Whistle, the Journal of the St. Louis QRP Society, and is reprinted here with permission.]

There are a couple of interesting points about this meter. The 200uA meter is the exact meter used for the original St. Louis Tuner in 1995. The voltage readings at 10 mW suggest that readily available silicon or germanium diodes will work in the circuit. Calibration curves using 1N914 and 1N34A Diodes will be included in the next installment. Using the ungrounded shield as the transformer along a 4” piece of coax means the cable can be bent into a “U” or literally tied into a knot and still work. Therefore the project can be tucked easily inside of a rig as long as there is panel space for the meter.

PROTOTYPE



DETAIL - COAXIAL T1



CALIBRATION DATA (PWR IN ON J1, 50Ω LOAD ON J2)

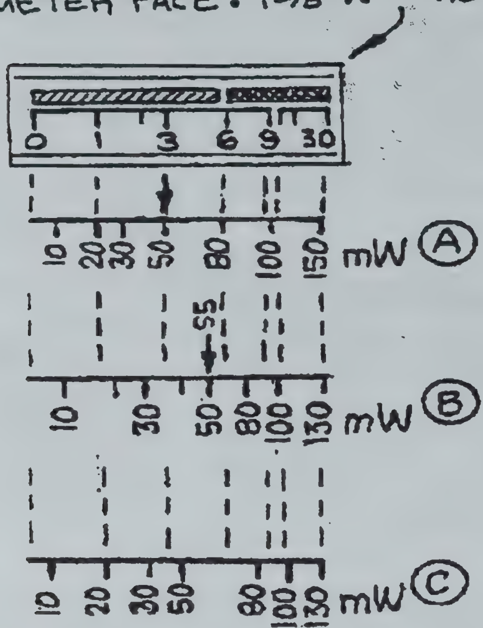
POWER IN (J1)	V1	V2
100mW (+20dBm)	4.6Vpp	0.66VDC
80mW (+19dBm)	3.7Vpp	.58 VDC
64mW (+18dBm)	3.4Vpp	.48 VDC
50mW (+17dBm)	3.0 Vpp	.40 VDC
40mW (+16dBm)	2.6Vpp	.33 VDC
32mW (+15dBm)	2.4Vpp	.18 VDC
25mW (+14dBm)	2.1 Vpp	.14 VDC
20mW (+13dBm)	1.9 Vpp	.11 VDC
16mW (+12dBm)	1.7 Vpp	.08VDC
12mW (+11 dBm)	1.5Vpp	.06VDC
10mW (+10dBm)	1.3Vpp	.04VDC

V1 AS MEASURED BY TEK 475 OSCOPE

V2 MEASURED WITH RADIO SHACK 3A7 D.V.M.

VOLTAGES MEASURED AT 3.5, 7, 10, 14 AND 21 MHZ WITH VERY SIMILAR RESULTS. VALUES SHOWN FOR 10.10 MHZ.

200µA S-METER
METER FACE: 1 3/8" W x 9/16" H



METHOD A (PREFERRED)

SET SIG. GEN. OR XMTR FOR 3.0Vpp AT V1 (D2) WITH 50Ω DUMMY LOAD ON J2. THIS IS 50mW INPUT (+17dBm).
ADJUST RV1 FOR S3 READING.
.10–150mW USE SCALE "A"

METHOD B

SAME AS ABOVE, EXCEPT SET RV1 FOR S5 AND SCALE "B". FOR BETTER RESOLUTION BELOW 50mW.

METHOD C

SET XMTR TO 100mW OUTPUT. (~4.6Vpp AT V1 OR +20dBm IN)
SET RV1 FOR S9+10dB READING AND USE SCALE "C"

72, Paul NA5N

The Perfect Kit

by James R. Duffey KK6MC/5
30 Casa Loma Road
Cedar Crest, NM 87008

The VE3DNL marker kit is as near to a perfect kit as you can get. If you are starting the Elmer 101 project you may wish to build one of these first. It is a useful piece of test equipment, and if you are a new comer to kit building, this simple kit will teach you many of the skills necessary to build a successful kit. It has few parts, is easy to trouble-shoot and is nearly foolproof.

What is the VE3DNL marker kit? It consists of an oscillator/divider IC and a crystal that generates your choice of 5, 10, 20, or 40 kHz markers through at least 30 MHz.

What use is such a thing?

Well, you can use it as a poor man's signal generator to align receivers. It can also be used as a frequency meter to calibrate your receiver. Say you want to mark 7040 on your SWL-40+. Tune in a W1AW code practice session. Switch the antenna input to your VE3DNL marker. Use the 40 kHz output. Tune down from the W1AW frequency until you hear the marker generator. Mark 7040 on the dial. Then switch to the 5kHz position and mark those positions on the dial. Voila! A calibrated dial. Plus, if you zero beat the crystal to WWV, your calibration is traceable to NIST! Sit your rig on 7040 kHz and peak up the input bandpass filter for maximum response. Keep it there and tweak the BFO trimmer for the best offset. I also keep one in the shack. I can use it to see if the band is dead, or if there is a problem with my rig.

For further details and a picture, see the NorCal site:

http://www.fix.net/~jparker/norcal/marker/marker.html

This simple, invaluable piece of test gear is brought to you by the Ft. Smith QRP group. They use the proceeds to fund speakers for Arkiecon, an amazingly wonderful gathering of QRPers held each spring in Ft.Smith, Arkansas. Go if you are within a days drive of Ft.Smith.

You can buy this miracle for only $12, including shipping. Order it from:

Jay Bromley W5JAY
9505 Bryn Mawr Circle
Fort Smith, AR 72908-9276

Now, you really should order more than one of these. It is an ideal way to get new hams (and old ones for that matter) into building. Buy a couple and pass them out to new hams when they show up with their new license. When the new licensee passes his test, put one of these in his/her hand and say; Welcome to ham radio, now you can find out about the joy of building your own equipment. When somebody complains that they would buuild, but test gear is too expensive, turn them on to the VE3DNL.

They also make a great group project for your club meeting. They are quite inexpensive, the success rate is high, it only takes a half hour to build, and they are easy to trouble shoot.

The quality of the kit is high. Dave Fifield, AD6A, laid out the PCB. Dave is noted for his first pass successes. The instruction manual is clear and concise.

If you don't have one of the VE3DNL marker kits order one now. If you already have one, order another one for a new ham. They make great gifts. I have three of them. Don't get me started on how great a kit the Tuna Tin 2 is! Stay tuned. - Dr. Megacycle KK6MC/5 "Radio Green Chile"

Do You Know How Great A Kit the Tuna Tin Two Is?

by James R. Duffey KK6MC/5
30 Casa Loma Road
Cedar Crest, NM 87008

If you have been reading the recent posts about all the fun that people are having with their Tuna-Tin 2s and are wondering how you can join in, wonder no longer! The Tuna Tin 2 kit is available from the Ft.Smith QRP group for $12 including shipping. See:

http://www.fix.net/~jparker/norcal/bttfut/bttfut.htm

The Tuna Tin 2 is one of those timeless pieces of gear. Designed and built by Doug DeMaw, W1FB and described in the May 1976 QST, it has all the parts necessary to function, but no more. A tuna fish can serves as the case. In an emergency catfood, pineapple, or smoked almond cans can be substituted. The Tuna Tin 2 was updated by Dave Meacham, W6EMD, at Doug's, KI6DS, urging a few years back. They did a great job updating it with modern components and now it works better than the original. It will attract comments from whomever you show it to, ham or not.

It is a good way to learn about oscillators and amplifiers. The 2 in

the name stands for 2 transistors. The first is used as a crystal oscillator and the second as a power amplifier. The manual and web page contain explanations of what all the parts do, so it is an ideal kit to learn why rigs have those 0.1 uF caps everywhere. Finger tip T/R switching is provided, so all you need to get on the air is a receiver. The receiver portion of any HF transceiver will do.

So send your $12 ($15 US for DX) to:

Jay Bromley W5JAY
9505 Bryn Mawr Circle
Fort Smith, AR 72908-9276

If you can corner Jay at a Hamfest he will sell you one for $10 as he doesn't have to pay the shipping. Buy him a diet Dr. Pepper for providing this service.

Now Jay will ship 10 or more of these kits to one address for $10 a piece. They go together in an hour or two, are easy to trouble shoot, and make a good group building project. These also make great gifts, door prizes, awards, and incentive rewards for upgrading. Help Santa put one of these in your favorite ham's stocking. It might be the ideal way to thank that Elmer that got you started in Ham Radio or building.

I guess that I am sounding like a bit like a shill for the Ft.Smith QRP group these days, but they do offer two simple ways to get into QRP building. Buy both. And they fund Arkiecon with the proceeds. See you at Arkiecon in April. - Dr. Megacycle KK6MC/5 "Radio Green Chile"

MY ANTENNA FARM

by Eric Silverthorn... NM5M

My entry into to the world of low power operation occurred about three years ago. My family and I moved to a new home located in a suburb just north of Dallas and, as expected, the new neighborhood deed restrictions prohibited all visible antennae. I knew that in order to comply with the deed restrictions a stealth antenna would be necessary.

I envisioned building a random length dipole that would lie on the shingles of my roof and could be fed off center with a 450 Ohm ladder line. The ladder line would be connected to a 4:1 balun that would allow me to run a short length of coaxial cable into my shack. Our home is two stories tall with the roof peaking at about 20 feet.

Three weeks after moving in, under the cover of darkness, I climbed out a second floor window onto the roof, armed with the materials and hand tools necessary to build the antenna. I located a vent pipe at a

peak of the roof that looked ideal for a feed point support. I secured the ladderline to the vent pipe with ty-wraps and tape and attached one leg of the dipole that slopes about 25 feet down the roof. Once the second leg of the dipole was connected to the feed point I attached a weight to the wire and tossed it across the highest point of the roof. This allowed the wire to run 20 feet horizontal and 15 feet vertical off of the side of the house. (Figure 1) The installation took about 20 minutes and, after running the coax through a window, I was ready to connect the antenna to my transceiver.

I decided to try 20 meters. Listening across the band I heard many loud stations throughout Europe. With the transceiver output power at 100 watts I called a station in Russia. He answered my call and gave me a 589 report. While running 100 watts I knew that I was interfering with the television, and phones in our home. I began to reduce power and found that at 20 watts there was not a trace of RFI/TVI. I worked two stations in Europe while running 20 watts, and received reports of 569/579. I had never tried QRP before so I thought that it would be interesting to drop the power to 5 watts to see if I could work anyone. I heard a strong station calling CQ from the Czech Republic. I called him once and he answered! From that point on I have been hooked on QRP!

Since installing my stealth dipole three years ago, I have completed QRP WAS, and have 56 countries confirmed towards DXCC on 10 through 40 meters. My best contacts so far are 3B8CF in Mauritius, and several stations in Central Asia.

I cannot provide evidence that my antenna has specific technical attributes that make it better than anything anyone else is using, however it works for me. I encourage those in a similar situation to “throw some wire across the roof” and get on the air, you might be surprised with the result!

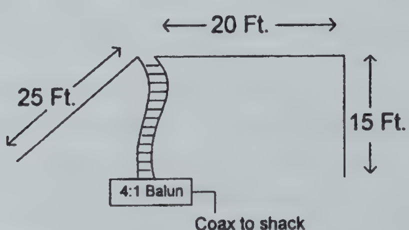


FIGURE 1

PRINTED CIRCUIT BOARDS FOR HAMS

by Ted Williams, G0ULL

Introduction

Thanks to the ubiquitous Personal Computer, the task of producing artwork for printed circuit boards has become much easier than hitherto, for professional and amateur alike.

The problem of manual layout and messy tape masters is now history; ease and precision are presently available for a very modest investment in computer programmes.

However, the production of hardware, actual boards, is currently beyond the pc's ability, and it this area which I propose to explore in this article.

The Artwork

The starting point is a print-out of the computer-aided design for the printed board, on an acetate sheet. I use an inkjet printer, and have found it essential to use the correct recommended material, and to print onto the correct face, which has a roughish coating.

Tip 1: Don't finger it, and don't use water or other solvents on it - it will wash the surface off - I found out the hard way.

Tip 2: The acetate film is relatively expensive, and my pcb programme prints the layout smack in the middle of an A4 sheet. For a small board, that's an awful lot of waste, so I do a print onto paper first, then cut out a bit of acetate a bit bigger than the print and tape it down on top of the print. Put through the printer again (right side down, dummy) and with luck and a following wind you should have an economy print. Give it a few seconds to dry fully

A laser printer is probably even better, but once again, don't be a cheapskate on the acetate sheet - you could wreck the printer. (low melting-point transparencies can fuse to the drum)

The quality of the artwork should be checked by looking through it at a bright light. Any bare patches or large pinholes can be blotted out with a water-based black marker, a fine tip being ideal.

Which way up?

Artwork programmes allow you to put components on the front, and look 'through' the board to see the copper layer. Now, remember it is vital when printing on to the copper to ensure that the INK side of the artwork is against the copper. The apparently small thickness of the acetate sheet is enough to disperse the exposure light, giving poor definition on the final print.

If you think about it, you will realise that this means the copper layer shown in the screen layout WILL NEED TO BE MIRROR IMAGE to print correctly.

Tip 3: Put a bit of text on the artwork, it will help to get it sorted in the mind.

The copper-coated board

There is a range of materials and thicknesses, but for most purposes I have found it best to use standard one-sixteenth of an inch (1.6 mm) fibreglass board (a sort of greeny colour), either single or double sided copper according to requirements. I have needed thinner material on the odd occasion, and there is some 1 mm board around.

Sensitising the board

It is necessary to coat the copper with a suitable resist, i.e. a coating which is changed when ultra violet light falls on it, such that is soluble in an appropriate chemical, while unexposed portions are not soluble.

I buy board ready coated - it's a relatively small outlay for the ease and certainty of printing. So far, I've not had problems of shelf life; indeed I have successfully used coated board which was several years old. (more than I can say for the cans of resist).

The alternative is to coat your own board, and positive resist is available in spray aerosols of around 200 ml (about 7 ounces for colonials). Before coating, the board must be SCRUPULOUSLY clean. I use a small abrasive block designed for the purpose which is cheap enough, a tiny bit of detergent initially and lots of water until the water runs off cleanly from the surface. (NO, not wire wool or carborundum, but 'Scotchbrite' is o.k.).

Tip 4: KEEP YOUR GREASY FINGERS OFF THE SURFACE - that could be enough to wreck your final print.

After drying THOROUGHLY, you can spray the board in subdued lighting, no bright sun or high intensity lights, according to the instructions provided with the resist.

Again, the coated board must be allowed to dry thoroughly, as recommended, in a dark place. It can be speeded up by heating, but remember a domestic oven, particularly gas fired, is not a dark place

Exposure

Here we need a source of ultra violet light, and the most convenient form is a uv tube, or tubes, mounted in a box behind a glass plate. I made my own using two 6 inch tubes, a rescued choke and a starter switch. Exposure, established by trial and error, is about 4 minutes. The uv boxes are available commercially, but are a bit pricey in the UK. I have used available sunlight on a board 2 feet long by 9 inches wide, with total success (about 20 minutes exposure here to the midday sun

- I can't answer for yours). Tony, G4WIF, intends trying an e-prom eraser, which may be suitable for small boards'

Using a uv box, first the artwork is put on the glass top, ink side up, then a suitable sized piece of sensitised board is put on top and the lid closed, a pressure pad ensuring the two are held in close contact. The uv is switched on for the appropriate time. If you don't know the timing, use the photographic test strip technique with a piece of scrap board, exposing a number of portions for increasing times, then pick the best on development.

An ordinary clock is alright for timing - we are not looking for precision - but if you fancy designing a timer you can automate the process. That could be your first project.

Development

Still maintaining the subdued lighting conditions, the board is immersed in a developing solution and gently rocked. A photographic dish is ideal, but any flat-bottomed dish will do. There are commercial reagents, but I use a 2 percent solution of Sodium hydroxide, or caustic soda. Development takes about a minute or so, and you can see the pattern emerging as the exposed resist is removed. Just ensure the pattern is clear, then wash in plenty of water. You can now revert to normal lighting.

The chemical is available in commercial quality flake or pellet form at hardware stores, and it is cheap. A suitable solution is about a level teaspoonful in a pint of water, and it gets slightly warm on dissolving. (Don't use the best cutlery; use glass or plastic to stir)

Tip 5: Keep the Sodium hydroxide stock tightly sealed, the flakes will absorb water from the atmosphere very quickly and deliquesce.

Tip 6: This stuff is corrosive, and proper precautions should be taken. It will dissolve finger prints (which could be an advantage) and eye splashes must be avoided, preferably using protective goggles - use plenty of water in case of splashes. These are sensible precautions, and in many years of handling it I've never had an accident.

Tip 7: Keep your fingers off the copper, still.

Etchants

It is necessary to use a suitable acid for etching, and the materials normally used are-

(a) Ferric chloride, available as hexahydrate crystals from electronic supply houses (Maplin or Farnell in the UK). 500 grammes makes about a litre of etchant - or follow the instructions if provided.

Tip 8: This is a dirty brown solution, and will stain anything - make sure it's not you.

(b) Sodium persulphate or Ammonium persulphate, preferably with a few drops of saturated Mercuric chloride solution as a catalyst, but it doesn't matter if you've not got it (It's very poisonous). 200 gm per litre of the persulphate works fine.

Tip 9: Both solutions are strongly acidic, and safety precautions against splashes should be taken. They are quite happy to etch holes in clothing as a bonus, so be warned. Also, DO NOT stir with a metal implement, although platinum or gold are o.k.

Etching

Most of the time, a photographic developing dish is perfect to contain the etchant. Use enough to submerge the board, and keep it in motion by rocking, just as in photographic developing - don't splash. Warming the solution will speed up the process - I float the dish on hot water in a larger bowl. This operation is performed in full light, and with fresh etchant you can reckon on something like 20 minutes for completion

If you can afford it, a small tank is available commercially for the amateur, with agitation provided by blowing bubbles through the solution using a small air pump (as used for fish tanks, get the larger one if you make your own). A fish tank heater is included in the kit, and etching times are really reduced – say, to 5 minutes or so.

Now is the moment of truth. Give the board a thorough wash in plenty of water and examine the result critically. If there is the odd whisker remaining, it can be removed with a scalpel or 50 amps; I prefer the scalpel.

At this stage, you have a perfectly useable board, and the unetched copper still has resist on it. This can be removed with a solvent such as acetone, or exposed to uv and developed off in the caustic soda solution.

Tip 10: I leave the resist on, and I find it makes a fine flux as well as keeping the copper clean.

Tin plating

On through component boards, I find this unnecessary. For surface mount boards, it is essential to coat the board, either solder coat with a soldering iron for small boards, or use electroless plating salts for larger boards.

Tip 11: When coating with a soldering iron, use extra flux so the solder flows evenly, then wipe the lot off while molten with a piece of cotton rag, leaving a thin, even coat.

Plating involves cleaning the copper surface thoroughly - back to the abrasive block and water, or develop the resist off, as mentioned. Then dunk the board for about 20 minutes in a solution of a commercial 'Immerse Tin' powder - it's as simple as that. (Farnell and Maplin again in the UK, but watch the quantity - 5 gallons is TOO MUCH, even for a

Texan).

...and in Conclusion......

I've used a lot of words to describe what is essentially a very simple process, but I've done it in enough detail to pretty well guarantee success. I've described single sided board preparation, but double sided is feasible, though I have never needed to do this. (Hint: you need locating points).

I have succeeded in producing very fine tracks with good definition from inkjet artwork, and have had no significant problems.

Ted Williams, G0ULL

Hotel Portable QRP Operating

By David Bixler WØCH
PO Box 707
Seneca, MO 64865
www.qsl.net/w0ch

One of the fun aspects of QRP is the ability to pack along a compact portable station when traveling. My wife and I enjoy traveling, both overseas and here in the US, and on most trips I have a little rig nestled down in a corner of the suitcase. In the evenings while Nancy reads or watches TV, I enjoy the challenge of getting on the air from our hotel room.

Hotel operating is often not easy and a bit of luck is needed to get a situation where a workable antenna can be deployed. Many of the newer US hotels are concrete and steel RF-proof boxes with windows that may or may not open. I usually try to avoid high-rise buildings and choose two or three story hotel structures with internal corridors. By requesting a quiet, upper floor room on the "back side", most of the time I can get an opportunity to get a wire out of the window.

In Europe, I have found that older hotels are much more RF transparent due to less steel reinforced concrete in their construction. Indoor wires seem to work better there than in the US. Also, many European hotels do not have window screens, making antenna deployment easier.

I try to set up a covert portable station to avoid confronting the management or disturbing other hotel guests. By restricting operation to after sunset, an antenna can be deployed out the window without attracting attention. My usual choice for an inconspicuous antenna is 33 feet of very thin wire lowered out the window or pitched into a nearby tree or bush. I use wire removed from the ringer coil of an old mechani-

cal telephone ringer. I don't know for sure what the wire gauge is, but it is so thin that I have trouble seeing it in the room and it is invisible outside.

A 33-foot length of outdoor wire can be used on either 20 or 40 meters. Inside the room, I lay out a counterpoise wire of either 16 feet (for 20 meters) or 33 feet (for 40 meters). If the situation won't permit the full 33 feet of wire outside the window, I make the wire as long as possible. An Emtech ZM-2 tuner works great to tune any combination or length of wires.

Window mounted whips like the W6MMA MP-1 or the B&W Travel Antenna should work well on higher bands but are more visible. Being a typical ham, I built a homebrew copy of the B&W antenna and have used it on several trips for 20 and 40 meter operation.

I have used many different QRP rigs over the years when traveling including Heath HW-8, NorCal 40A, NorCal 20, SW-20+ and the Elecraft K1 and K2's. All are fine rigs, but I have found that 5-watt rigs are a bit better in producing contacts using marginal antennas. Currently, I use an Elecraft K1 on most trips with pretty good results. The internal battery and antenna tuner make the K1 an excellent travel rig, plus it works my favorite two bands.

Always use headphone to prevent disturbing the neighboring rooms. As for a power source, most of the time I use batteries to reduce AC power line noise. After the operating session, the batteries are recharged using a wall wart power supply. If AC line operation is desired, the compact CUP-12 power supply from Milestone Technologies is a good choice to run that 5-watt rig.

Working QRP hotel portable is challenging, to say the least, but it beats watching TV on those evenings when you are on the road. Give it a try on one of your next trips.

IS SMD OK 4 QRP?
Some comments on surface mount components.

by Ted Williams, G0ULL

The electronics manufacturing world is increasingly turning to surface mount technology in circuit board assembly, so clearly it must offer certain advantages.
Some fairly obvious ones for the industry are:-

- No board drilling
- Small size components, i.e. compact

- Relatively small assemblies, reducing board costs.
- Easy automatic placement (no lead bending, insertion or cropping)
- Easy reflow soldering (under infra red)

Apart from the last item, these advantages are still more or less relevant to the amateur.

Costs

As far as I can see, SM components tend to be cheaper than their through-hole counterparts, even in modest quantities, no doubt because the lead attachment problem and associated cost is avoided.
Components can be recovered from junk populated boards, but it is never clear quite what they are, viz, no tolerance, power or voltage ratings. New is generally a more reliable choice.

Range

Components available include R, C & L, and there are SMD equivalents of most common ICs, transistors and diodes; indeed an increasing number of semiconductors are available only in SMD form, such as DDS chips. There are already indications that a number of leaded components are being phased out as the demand polarises in favour of SM assembly.

Component size

There are a number of fairly standard sizes, for example resistors range from the massive 1206 case (0.12 inches long by 0.06 wide - roughly an eighth by a sixteenth of an inch) down to half this size - 0603. Just don't sneeze.

A 0.1 uF capacitor at 50 v working is no larger than a resistor. Transistors and ICs are also smaller than the leaded types, and space between leads-out can be reduced to a half millimetre. Note that due to the size, there not enough space to code many of the components, so that care is needed to store them without losing their identification.

Circuit advantages

From the circuit design viewpoint, the small physical size of the components means that the strays associated with larger components are largely avoided, i.e. low added inductance due to short component body and no leads, lower self capacity due to the small profile and shorter path lengths on the circuit board.

The effect is that circuit performance, particularly at high frequencies, is enhanced and much closer to theoretical design parameters. Further, the low profile is a help in reducing cross coupling, though normal layout precautions should be observed (like avoiding earth loops).

Can Hams use them?

Certainly from my own experience in assembling SMD kits and

some home brew, the answer is entirely positive. Even board layout seems easier, and simple boards can be cut with a hobby knife rather than etched. Crossovers can be achieved by using resistors coded '000' – yes, zero ohm resistors.

A soldering iron with a fine tip, say ½ mm diameter, makes life fairly easy. A silver-loaded solder is preferred to avoid leaching the silver from the component ends, though ordinary solder will serve. A recent advance has been to apply a nickel flash to the silver end connections before tinning, which reduces the leaching problem. Small diameter solder is essential in my view to control the amount applied, and 26 swg is about right. (0.018 inch dia., about 25 AWG) Many people may find a magnifier helpful, and the combination of a bright light and a headband magnifier makes life fairly easy. The affluent may prefer an Anglepoise type lamp, using a circular fluorescent lamp round a large diameter lens. (I bought one advertised in Practical Electronics for £50 – excellent value). The fluorescent lamp has the advantage of running cooler than an incandescent lamp – a considerable advantage in the summer months.

An essential tool is something to hold the component in place while soldering. At a pinch, an orange stick will serve, but I made a spring-loaded plunger tipped with PTFE which seems to work well. Tony, G4WIF, uses a converted wire coat hanger to good effect (easier on the pockets?)

Summary

Yes, SMD is readily useable by the Ham community, indeed it may have to be taken on board by confirmed home-brewers if the reported shortage of leaded types becomes serious. My personal view is that it is actually easier to lay out a board, quicker to fit components and gives better results than through hole assembly. The range of components in your armoury is increased.

Ted, G0ULL

Build a Logging Frequency Counter (using your PSK Audio Beacon circuit board)

by George Heron, N2APB, email: n2apb@amsat.org
2419 Feather Mae Court
Forest Hill, MD 21050

One of my great fascinations is finding multiple uses for any given radio, accessory or project. And even more so if the project happens to have a microcontroller because of the flexibility offered by being able to install new software to give the project new features.

Such is the case with the NJQRP "PSK31 Audio Beacon" project, described in August QST and elsewhere in this QRPp issue. With some new software and a single transistor, you can turn the Beacon circuit board into a frequency counter with a real unique capability.

You see, many other PIC-based projects provide the frequency counting feature. It's really pretty simple to do – the PIC software just counts up the number of cycles occurring in the input signal during a fixed time interval, performs a little math, and *bingo*, you've got the frequency. The digits of the frequency are then usually displayed on an LCD or on some LEDs, annunciated by audio Morse, etc.

I've whipped up some new software for the Beacon project that performs that frequency counting function. But since the Beacon pcb has a built-in RS-232 serial port, it is able to send the numbers out the serial port at 9600 bps to a logging terminal, printer or computer running a terminal emulator program like PROCOMM. Additionally, since the serial port is bi-directional, the operator can use the terminal keyboard to send simple commands to the Frequency Counter board – commands like: change sample time intervals and frequency resolution, select continuous sample & report or one-time sample, set delays between continuous samples, and more.

The simple circuit shown below is added to the PSK31 Beacon board to shape the signal being measured. Just make this 15 minute mod, download the software from the NJQRP website (or order a new pre-programmed SX chip) and you'll be measuring frequencies of your favorite project on the bench and logging it to a text screen on your computer! Full details and source code can be found at:

www.njqrp.org/freqcntr.

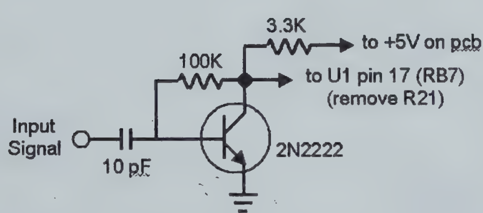


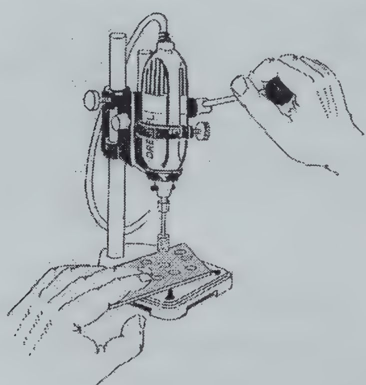
Fig. 1 Mods to PSK31 Beacon

NJQRP "Islander" Pad Cutter

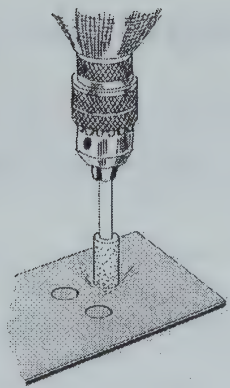
by George Heron, N2APB, email: n2apb@amsat.org
2419 Feather Mae Court
Forest Hill, MD 21050 USA

Here's a handy and inexpensive end mill that can be used to cut "islands" into copper clad circuit board material. This technique of cutting small isolated pads right on the copper ground plane is an alternative to the Manhattan-style construction technique of creating separate pads that are glued down. The Islander pad cutter tool was envisioned by a member of the New Jersey QRP Club (**Dov Rabinowitz, AD0V**) while sitting in a dentist's chair during a regular check-up. He later hunted down a manufacturer of a little 5mm-diameter diamond-tipped end mill, and then worked with the NJQRP to place a bulk purchase so the club could sell to homebrewing QRPers everywhere. Master illustrator **Paul Harden, NA5N** graciously agreed to help us document use of the end mill, and Manhattan-style expert **Jim Kortge, K8IQY** provided some sample circuits and photos to use in the article as well as the "manual" we provided with the pad cutters.

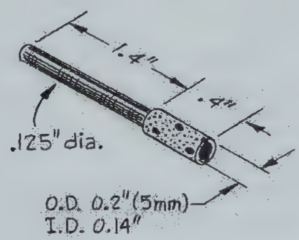
NJ Islander bit can be chucked up in a bench mounted drill press, or just as easily in a hobbyist's Dremel tool and inexpensive tool stand.



It's important to drill the islands perpendicular to the board to prevent "bit walking". A little water on the cutting surface helps. Be careful not to cut all the way through the fiberboard substrate, and to carefully clean out the drilling debris from the circular holes. (Check for shorts with an ohmmeter.)

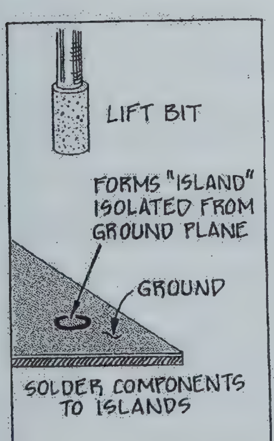


NJQRP Islander Pad Cutter dimensions

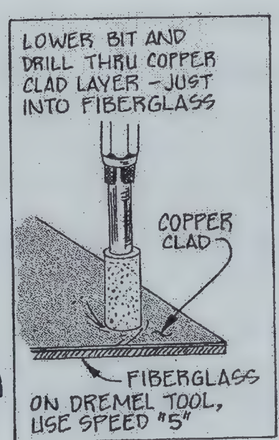


NJ Islander bit creates an "island" from the surrounding ground plane. Components may be soldered to the island just like when using Manhattan pads.

Make the island cuts at 90-degrees at Dremel speed "5". It's helpful to use a little soapy water to keep the soft copper from clogging the diamond edges.



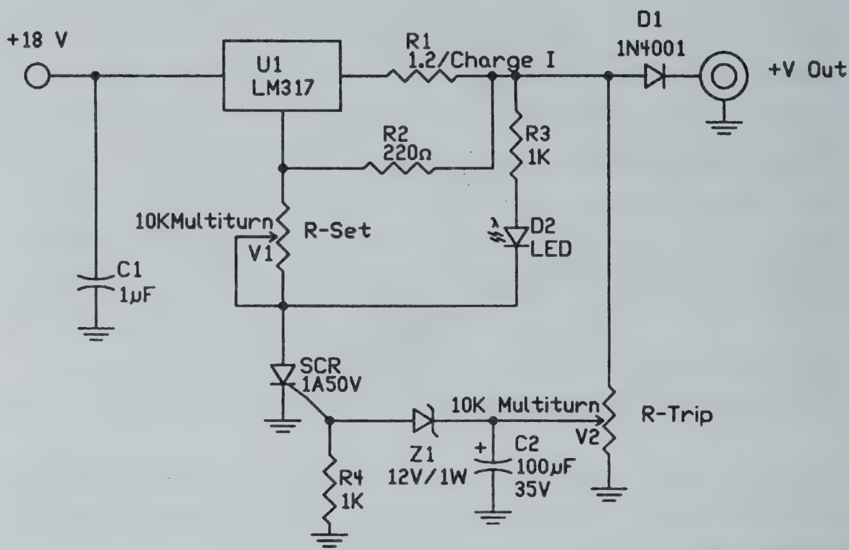
72, Paul NA5N



An Automatic 12V Gel Cell Charger

by Jim Duffey, KK6MC/5

This circuit first appeared in Sky & Telescope in 1989. Hainer wrote the article, and it is unique in that all of the parts are available from Radio Shack. It lends itself perfectly to Manhattan style construction. Enjoy. 72, Dr. Megacycle



1. Charge current can be 0.1 to 0.3 times C where C is amp hour capacity.

2. R should be rated > I^2R, where I is charging current.

3. Set R-Set for 13.8V with LED lit. Use digital voltmeter. If LED is not lit adjust R-Trip until it is.

4. Connect battery and start charging. Monitor Battery Voltage. Adjust R-Trip so that LED lights at 14.4V

5. Parts available at Radio Shack

6. Low dropout regulator may be used.

Put your SMK-1 on 80 Or 160 Meters

By Wayne McFee, NB6M

Having had enough fun with my VFO equipped and 5 Watt Mod equipped SMK-1s on 40 meters to want to try something different, I thought, with 80 and 160 Meters now open during the winter, why not put an SMK-1 on one of the lower bands and see what activity I could scare up.

By staying with crystal control, the SMK-1 can quickly and easily be put on a different band by making appropriate changes to the receiver's tuned input circuit, changing a few capacitor values in the oscillator feedback circuits and changing the values in the transmitter's output network. Crystals for either 80 or 160 Meter operation are readily available from Radio Shack, either online or by calling 1-800-THE SHACK. The rest of the parts needed to make the change may well rest, awaiting use, in your parts bins.

In addition, the circuit can very easily be modified to provide for a separate receiver RF input so that the low noise advantage of a small, tuned loop antenna with an appropriate RF preamp could be realized, especially on 160 Meters.

Sure, the amount of tunable frequency range will be even less on 80 or 160 than it is on 40, but the SMK-1 is basically a rockbound, single frequency transmitter with a slightly wider bandwidth receiver anyway, so the limitation is really not all that constricting. Think of it as having a rockbound transmitter and a rockbound receiver with RIT. My 80 Meter SMK-1's receiver has just over 1.5 Khz of frequency range.

As observed with the 40 Meter SMK-1, the receiver's Local Oscillator drops out of oscillation past a certain point of VR2's range. This doesn't really hurt anything, but is something to be aware of, especially when you first turn the rig on after modification. Start with the pot all the way to the left, counterclockwise, and it will be oscillating just fine.

Also, as the SMK-1 is known for its characteristic small amount of transmitter chirp, especially on the higher end of the transmitter's tuning range, stability is improved, resulting in no chirp, by disabling the transmitter's tuning circuit. Since there was very little transmitter tuning range anyway, and there will be even less on 80 or 160, this is no loss and your signal will sound much better. The transmitter's tuning circuit can be disabled easily by removing C16. Or, if you are just getting around to building your SMK-1 and want to put it on either 80 or 160 Meters, don't install C16, D6, D7, R7 and VR3.

Color burst crystals for 3.579 Mhz are commonly available, but with PSK-31 and other digital activity now in that part of the 80 Meter band,

there seems to be little or no CW operation there. Radio Shack part number 900-5085, a crystal for 3.686 Mhz, at $1.18, would make a much better choice, as that frequency falls right into the old Novice portion of 80 Meters. More CW activity has recently been heard in that frequency range than in the low end of the band.

Crystals for 160 meters, 1.843 Mhz, Radio Shack part number 900-5089, are available for $2.00 each.

Here are the changes I made in my SMK-1 to put it on 80 Meters:

Change X1 and X2 to 3.686 Mhz crystals
Add 130 pf NP0 across TC1
Change C1 to 160 pf
Change C2 to 940 pf
Add 240 pf NP0 across L2
Change C4 to 390 pf NP0 (probably should be 470 pr or so, but I used the 390 that was the old C24)
Change C5 to 150 pf NP0
Change C18 to 270
Change C24 to 820 pf, Silver Mica or NP0
Change C25 to 160 pf, Silver Mica or NP0
Change C26 to 1000 pf, Silver Mica or NP0
Change L5 to 2 uh, 22 T # 24 on T37-2

Note that wherever a capacitance value is increased, rather than having to remove parts, another capacitor of appropriate value can be soldered across the existing part. In this way, only L5 would actually need to be physically removed.

If that approach is taken, in addition to changing the crystals, do the following for 80 Meter operation:

Add 130 pf NP0 across TC1
Add 82 pf NP0 across C1
Add 470 pf NP0 across C2
Add 240 pf NP0 across L2
Add 270 pf NP0 across C4
Add 82 pf NP0 across C5
Add 100 pf across C18
Add 470 pf Silver Mica or NP0 across C24
Add 82 pf Silver Mica or NP0 across C25
Add 470 pf Silver Mica or NP0 across C26
Remove L5 and replace with 22 T # 24 on a T37-2 toroid

The 130 pf across TC1 was added in order to resonate the TC1, L1 combo to 80 Meters.

C1 and C2 changes, while perhaps not absolutely necessary, were made so as to maintain the same impedances seen by the signal coming from VR1 on 3.5 Mhz as was seen on 7 Mhz.
Probably, since the impedance of a parallel tuned circuit is very high at resonance, only the impedance ratio between C1 and C2 is important, and added capacitance wasn't needed. You are welcome to experiment. 240 pf was added across L2 to resonate the TC2, L2, C1 and C2 combo to 80 meters.

With these changes, TC1 and TC2 seem to peak the signal/noise level quite well on 80 Meters, but some experimentation may still be in order as to the exact value of capacitance to add across TC1 and L2 in order to get the "double peak" in the tuning range of the two trimmers, which should be there in order to indicate true resonance of the circuit.

In this case, the approximate values needed were determined by the simple expedient of first wiring an air variable capacitor across TC1, tuning for maximum signal, removing the air variable and measuring the resultant value of capacitance. An appropriate value fixed capacitor was then soldered across TC1, and the same procedure was used to determine the approximate value needed across L2.

Since C4 and C5 determine the feedback necessary to the oscillator in SA612, their values were changed so that their individual impedances would be the same on 3.5 Mhz as they were on 7 Mhz, in order to be sure that a sufficient amount of feedback for reliable oscillation was provided. C18, in the transmitter's oscillator circuit, was changed for the same reason. Again, you are welcome to experiment.

The remaining changes, to the transmitter's output network, were made in order to scale the values from 40 to 80 Meters.

Although the one quarter to one third of a watt normally realized from an SMK-1 should be enough to have many enjoyable QSOs on 80 meters, more than that may well be needed on 160. To increase the transmitter power output of the SMK-1, there are at least a couple of ways to go. One very simple modification which raises the transmitter output to around a half watt on 40 Meters, and results in three quarters of a watt of output on my 80 Meter SMK-1, is simply to lower the value of R-14 in the PA circuit.

Carl, K5HK, simply bridged R14 in his SMK-1 with a wire, directly grounding the emitter of his PA transistor. As he reported no obvious problems after several months of operation with R14 bridged, I gave it a try as well. This very simple mod raised the output of my VFO equipped 40 Meter SMK-1 from one quarter to one half a watt. Not earthshaking,

but a significant improvement for very little effort. After several months of operation now with that mod in place, no overheating or other adverse effects on the PA transistor have been observed.

I tried running the emitter of the PA transistor in my 80 Meter SMK-1 directly to ground as well, and realized just over .8 Watt. Due to the higher gain of the transistor on 3.5 Mhz, and wanting to forestall any possible problems of overheating or instability, I ended up bridging R14 with a 2.2 Ohm Resistor, which resulted in .76 Watt output into a 50 Ohm dummy load, with the little rig operating from an eight AA battery pack. No overheating or other problems with the PA transistor have been observed, and on-the-air signal reports are good. If you do this mod and your PA shows either any signs of instability or heating, try changing the 2.2 Ohm resistor to a higher value, perhaps 4.7 or even 10 Ohms. You should still be able to realize a higher power output than the stock SMK-1, with no overheating or other problems with the PA stage.

If you care to operate at the QRP Gallon level, a 5 Watt Mod as performed on the 40 Meter SMK-1 could be added to the rig. Suggested output network values are listed below:

	C1	L1	C2	L2	C3
80 Meters	820pf	21T#24 T50-2	1600pf	25T#24 T50-2	910 pf
160 Meters	1600	30T#24 T-50-2 or 28T#24 T68-2	2-1600pf in parallel	35T#24 T50-2 or 32T#24 T68-2	1800 pf

To put the SMK-1 on 160 Meters, the following changes are suggested:

Change X1 and X2 to 1.843 Mhz crystals
Add 590 pf NP0 across TC1
Change C1 to 330 pf
Change C2 to 1800 pf
Add 1430 pf NP0 across L2
Change C4 to 820 pf NP0
Change C5 to 330 pf NP0
Change C18 to 390 pf NP0

Change C24 to 1600 pf, Silver Mica or NP0
Change C25 to 330 pf, Silver Mica or NP0
Change C26 to 1800 pf, Silver Mica or NP0
Change L5 to 4.4 uh, 30 T # 24 on T37-2

As noted above, except for the removal and replacement of L5, capacitors of appropriate value can be soldered across existing parts to make the necessary value changes.

And, as indicated for the 80 Meter version, some amount of experimentation may be needed in order to bring the receiver's tuned input circuits within the range of the two trimmer capacitors.

How you effect these changes will depend on how well stocked your parts bins are. You may need to remove some parts and solder in the correct value, and you may be able to add the necessary value across other parts by soldering on additional capacitors. Surface mount parts are very easily removed by the use of two low wattage soldering irons at once. A handy damp cloth is recommended for wiping the removed part off of whichever iron it sticks to when it comes off the board.

If you, too, have had enough fun with your SMK-1 on 40 Meters to want a change, warm up your soldering irons and make the simple changes needed to put the little rig on 80 or 160. I hope to see you on the air. Enjoy. Wayne, NB6M

NorCal St. Aidan's Benefit Raffle Raises $2745.00!

by Doug Hendricks, KI6DS

This year's annual St. Aidan's Benefit Raffle at Pacificon was a huge success. We raised $2745 to send to St. Aidan's Church in England. This is the parish where Rev. George Dobbs is the Vicar. Rev. Dobbs, G3RJV, is perhaps the world's most famous QRPer, and has appeared at almost every QRP Forum in the world. He was a guest at Pacificon in 1998 and drew a huge crowd. George's parish has been very lenient in allowing him to travel to support QRP, and NorCal has sponsored a raffle the past 2 years with the proceeds going to the church as our way of saying thank you.

The raffle this year featured a K2 as the grand prize, donated by Elecraft. Red Hot Radio donated a Red Hot 40, Dave Benson of Small Wonder Labs donated a DSW20+, Martin Jue of MFJ donated a MFJ Cub 15 Meter kit, Vern Wright of Super Antennas donated a MP1 and an MP2 antenna, the St. Louis QRP Club gave a St. Louis Quickie Antenna Kit, NJ QRP Club gave several kits, including a Warbler, and a

Joe Everhart Gusher Antenna, Ft. Smith QRP Group gave away a Tuna Tin 2 and a VE3DNL Kit, the Arizona ScQRPions gave away a SSS Frequency Counter Kit, Dennis Foster gave away a TeNeKey, and NorCal QRP Club gave away a BLT Tuner Kit, the very last SMK-1 Kit, and a Toroid kit. As you can imagine, the parish was quite please to receive the donation, as they had no idea it was coming. Below is a picture of George Dobbs handing over a check for the raffle proceeds to the parish treasurer. I received a very nice thank you letter from her which I have reprinted here.

Debra Buckley, Treasurer of St. Aidan's accepts a check from the St. Aidan's Benefit Raffle Proceeds from Rev. George Dobbs, G3RJV.

Dear Mr Hendricks

As treasurer of St Aidans PCC (Parochial Church Council), I would like to thank you very much for organising your recent raffle in aid of St Aidans Church. The proceeds which you generously donated to us amounted to the grand sum of £1,875.43 and are very much appreciated. I speak on behalf of the PCC, and indeed the people of St Aidans, who at a recent meeting were very grateful and delighted at the announcement of your donation.

It would take a lot of hard work over a long period of time for

the PCC to be able to raise such a large amount of funds which are greatly needed for the life and work of our church.

As I am sure you are aware, it becomes increasingly difficult to meet our financial obligations and maintain the fabric of the church, whilst sustaining its life and work. Such a large and unexpected donation is a great surprise and very welcome.

Thank you once again.

Kind regards,
Debra Buckley
Treasurer

Many of you will receive this during the Christmas Holidays. What a great time to reflect on doing good deeds for others. Thank you for supporting the raffle with your ticket purchases. Thanks again to all of the vendors and clubs who donated every prize fully. Every penny raised went to the Church, nothing went for expenses, which were covered by NorCal, Jim and I. We will plan on doing another raffle next year. George, please keep up the good work in your day job too!! 72, Doug

QRPp Subscriptions

QRPp is printed 4 times per year with Spring, Summer, Fall and Winter issues. The cost of subscriptions is as follows: US and Canadian addresses: $15 per year, issues sent first class mail. All DX subscriptions are $20 per year, issues sent via air mail. To subscribe send your check or money order made out to Jim Cates, NOT NorCal to: Jim Cates, 3241 Eastwood Rd., Sacramento, CA 95821. US Funds only. Subscriptions will start with the first available issue and will not be taken for more than 2 years. Membership in NorCal is free. The subscription fee is only for the journal, QRPp. Note that all articles in QRPp are copyrighted and may not be reprinted in any form without permission of the author. Permission is granted for non-profit club publications of a a non-commercial nature to reprint articles as long as the author and QRPp are given proper credit. The articles have not been tested and no guarantee of success is implied. If you build circuits from QRPp, you should use safe practices and know that you assume all risks.

QRPp, Journal of the NorCal QRP Club
862 Frank Ave.
Dos Palos, CA 93620

First Class Mail
U.S. Postage
Paid
Mailed from Zip Code
93620
Permit #72

First Class Mail

Phil Westover WA7URV
10340 SW Hillview Street
Tigard, OR 97223
Subscription will end with Summer 03 issue.